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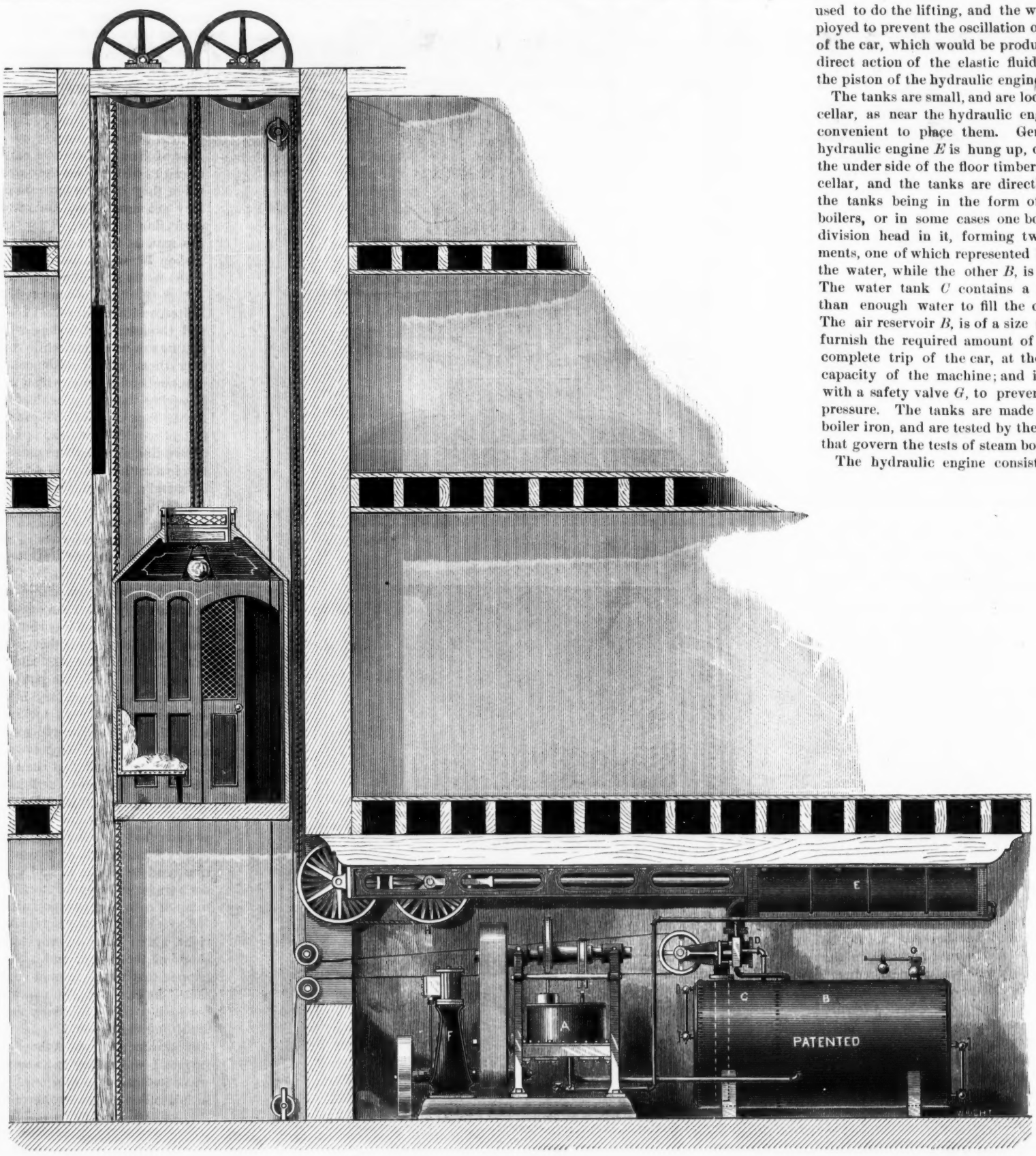


NEW SAFETY, HYDRO-PNEUMATIC ELEVATOR.

New Safety, Hydro-Pneumatic Elevator.

During the past few years rapid strides have been made among inventors in striving to produce an elevator that would combine speed with safety and economy. The reason for these efforts are obvious, as buildings are now erected much higher than formerly, and business is being transacted and merchandise handled upon upper floors, which require an easy access, also a quick and effective method of transportation from one floor to the other. To furnish these desirable advantages, the inventors have succeeded in producing some very valuable devices. The ordinary hydraulic elevators have a tank of sufficient capacity located upon the top of the building, and another tank in the cellar, the water being pumped from the cellar to the upper tank, and flowing from there to the hydraulic engine. The height of the column of water so obtained gives the pressure used to lift the load in the car. It is obvious that, with this form of elevator, it is necessary to use just as much water at the same height, or pressure, to lift a light load in the car as is necessary to lift a heavy load, the height of column and pressure remaining constant.

The Johnson & Bailey system, which is illustrated by the engraving upon this page, consists of the use of compressed air and water, wherein the air under pressure is used to do the lifting, and the water is employed to prevent the oscillation or vibration of the car, which would be produced by the direct action of the elastic fluid (air) upon the piston of the hydraulic engine.

The tanks are small, and are located in the cellar, as near the hydraulic engine as it is convenient to place them. Generally the hydraulic engine *E* is hung up, or bolted to the under side of the floor timbers above the cellar, and the tanks are directly under it; the tanks being in the form of two small boilers, or in some cases one boiler with a division head in it, forming two compartments, one of which represented by *C*, is for the water, while the other *B*, is for the air. The water tank *C* contains a little more than enough water to fill the cylinder *E*. The air reservoir *B*, is of a size sufficient to furnish the required amount of air for one complete trip of the car, at the maximum capacity of the machine; and is furnished with a safety valve *G*, to prevent excessive pressure. The tanks are made of the best boiler iron, and are tested by the same rules that govern the tests of steam boilers.

The hydraulic engine consists of a cylinder, having a piston of proper diameter and stroke for the work to be done, also a frame for supporting the sheaves, and guides for the traveling head. The multiplying gearing *H*, is similar to a huge pair of blocks, and consists, according to circumstances, of six, eight, ten, or more sheaves; each sheave being nicely turned and fitted for two wire ropes, and each rope proportioned to safely hold about ten times the weight it is calculated to hoist. With a ten

sheave engine of course the car travels ten times the distance in the same, or equal time, that the piston of the engine travels.

This form of hydraulic engine has been adopted because theory and practice have both demonstrated that there is much less loss from friction, than when the piston travels half the length of the travel of the car, or when any form of toothed gearing is used; it also occupies less room in the building, and that, generally, of least value.

The air is compressed by a compressor *A*, which was designed especially for this elevator, it being necessary to have a special compressor to fulfill the conditions necessary for this work, economically and with the least possible noise. The compressor can be driven by a belt from a line of shafting when there is power in the building, or when power can be hired from a neighboring building; or it can be driven by an engine *F*, upon the same bed with it.

The air is compressed up to 60 lbs., or more, per square inch above the atmosphere in the reservoir *B*. From the reservoir, the air passes as required to the top of the water tank *C*. The pressure of the air upon the surface of the water in the tank forces the water out through the pipes and valves *D*, into the cylinder *E*. When the pressure against the piston exceeds the amount necessary to overcome the friction of the machinery and the weight of the load in the car, the piston moves and the car is raised.

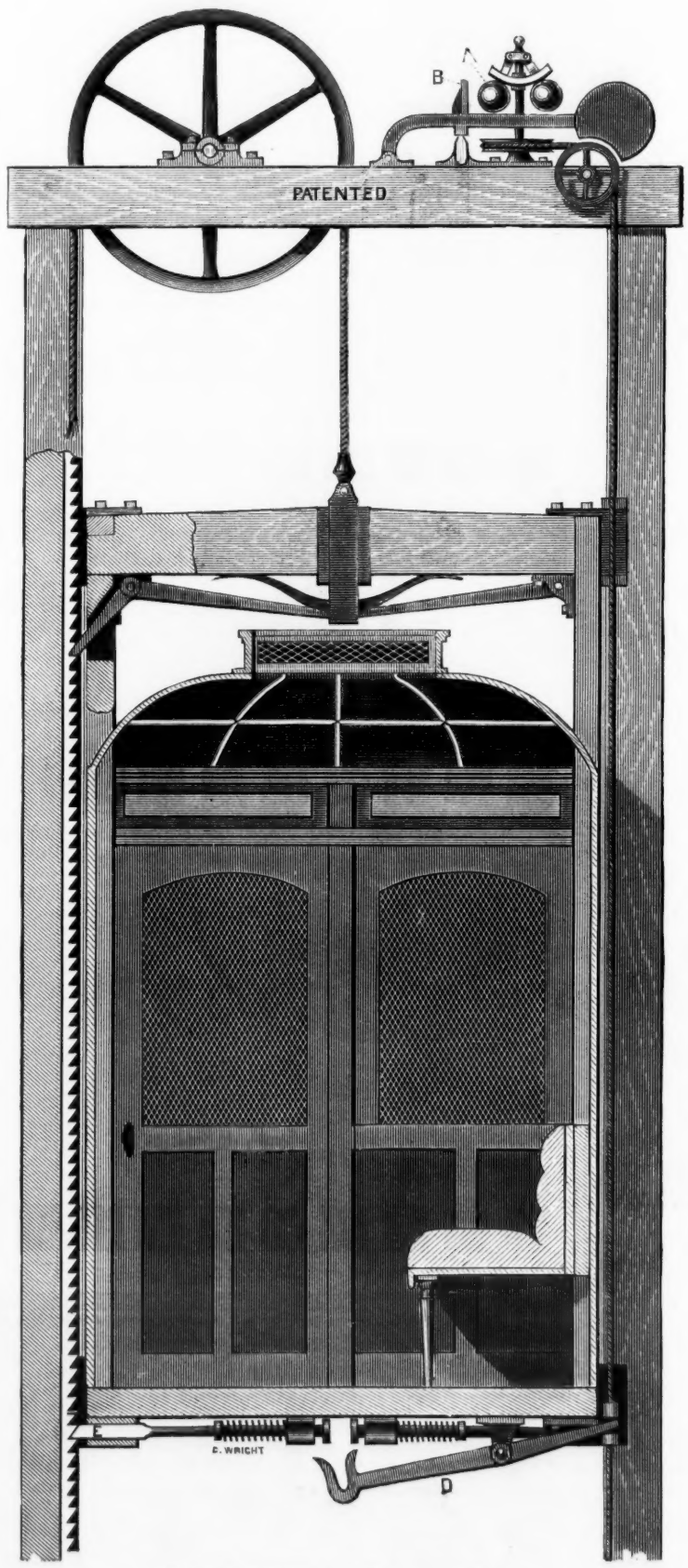
Between the air reservoir *B*, and the water tank *C*, there is an automatic regulating valve, which has the pressure of the air in the reservoir upon one side, and the pressure upon the piston, due to the load in the car, upon the other side. The difference in these pressures opens the valve enough to allow only a sufficient amount of air to pass to the water tank, to overcome the resistance offered by the load in the car. By this means a light pressure is supplied for a light load and a heavy pressure for a heavy load. The action is automatic, and the result very economical.

Another point of economical working is this: when the operator in the car pulls the cord to descend, the air-supply valve is shut, the water valve and exhaust valve opened, the air which has just been used to lift the load is exhausted from the top of the water tank *C*, into a pipe that leads directly to the suction of the air compressor *A*, and also to the back end of the cylinder *E*. As soon as the pressures upon the front and back side of the piston are equalized, which is almost instantly, the weight of the load in the car causes it to descend as fast as the water is permitted to be transferred from the engine cylinder, through the main or water valve, into the water tank. The speed is entirely under the control of the operator in the car, who can open or close the valve, more or less, at will. While the car is coming down, the compressor *A* is pumping the air, which has just been exhausted, back again into the air reservoir *B*, and, instead of pumping free air of 14.7 lbs. absolute or atmospheric pressure, the air is returned to the compressor at a pressure which will depend upon the weight of the load just hoisted. It may be 40 lbs. or 60 lbs. absolute pressure in the beginning, which will gradually be reduced by the pumping of the compressor until it falls enough below the atmospheric pressure to allow the suction check valve to open when free air is taken in.

By this arrangement the same air is used over and over again, the slight leakages, if any, being made up by the compressor from free air when necessary. The theoretical losses due to air compression are reduced to the lowest practical limits, and a smaller air compressor can be used than would be necessary to pump the required quantity of free air.

The guide posts for the car extend throughout the whole height of the building, from the cellar to the roof, and are faced with safety lock ratchets, between which the safety car platform is raised and lowered, by means of two wire lifting ropes which are connected with the hydraulic engine. The car platform is moved at any speed desired by the operator, and when stopped is held rigidly in place by the water between the piston and the valve. The valves are balanced and tight.

The car platform, illustrated by the engraving on this page, is fitted with safety locking pawls, combined with a powerful steel spring, and the simplest possible device for forcing the safety pawls into contact with the safety ratchets, should the lifting ropes break. These having been used for many years, have proved perfectly reliable, and can be depended upon to reduce the fall, possible to the car, to the length of the ratchet ooth.



SAFETY DEVICE FOR ELEVATOR CAR.

Besides the ordinary safety pawls attached to the lifting ropes, there is an extra set of patent safety pawls *E*, underneath the platform of the car, which are operated by a separate wire safety rope. This rope is a safety device entirely disconnected from any of the other working parts of the apparatus, and extends from the top to the bottom of the hoistway, running over pulleys at the top and bottom. Both ends are connected to the lever *D*, which operates the safety pawls under the car. The safety rope travels with and at the same speed as the car. In the upper part of the hoistway the rope passes over pulleys which give motion to a safety hammer or brake *A*. When the car is running at its ordinary speed, the safety hammer does not act; but as soon as the speed is accelerated beyond what it should be, the balls *A*, fly out and strike the catch plate *B*. The brake is dropped, the motion of the safety rope ceases, while the motion of the car detaches the lever *D*, releasing the safety pawls *E*, which spring into the safety ratchets, stopping the car instantly.

In addition to all the before-mentioned safety devices, there is also an automatic stop upon the hydraulic engine, so that if the check rope should break, and the operator lose control of the car, the hydraulic engine will stop itself when the car arrives at the top or bottom of its run.

Some of these elevators have speed of 160 feet per minute, and the motion is easy, being unaccompanied by any sudden jerks or oscillations in stopping. The passenger cars are neatly finished in woods of different colors. These elevators are manufactured and erected by N. B. Cushing, at the Jersey City machine works, foot of Morris street, Jersey City, N. J.

A $100,000 corporation has been organized at Chicago to take steps toward abating the nuisance arising from factory smoke.

Extracts from Chordal's Letters.

Mr. Editor:

* * * * Machinists, like all other men, often learn their trade with the intention of some day being in business for themselves. In fact, I suppose that an independent business is the chief end of all men, who have within them the real power of self reliance and independence. It really seems as though a machinist was unfortunate to have such desires. To enter, as an apprentice or workman, into a large and well-equipped shop and observe for years the deficiencies of even such a shop; to form ideas of how this matter ought to be arranged, these new machines which ought to be put in a new story which ought to be put on the building; increased facilities for handling the work, and a thousand other things which cost piles of money; to stay in this elegant shop where money is spent lavishly, and criticise every day the mere parsimony of the owners; to work for three dollars a day; and to hope some day to own a machine shop—all this seems idiotic, yet it is done every day. Most all our shop owners dug their money out of the shop. Most of these men were the most hypercritical of critics of the plant they worked with, but when they come to have shops of their own they get new ideas, and cease to talk of perfection in outfit. They soon learn that if a man is rich enough to get the kind of a shop he wants, he is rich enough to do without any shop at all.

* * * * This country is awful big, Mr. Editor, and with all repect for the thousands and thousands of lathes which this very minute are revolving while some chap leans over them with outside calipers; for the thousands of planers, which are this instant knocking their dogs against their tumblers; for the thousands of drill presses, which this instant would show their spindles gradually descending; for the thousands of vises, which this instant have a death grip on some piece of metal; for the shower of chips flying before the thousands of chipping chisels now creeping slowly forward before thousands of ball-pien hammers—with all repect for these many evidences of the existence of machine shops in this land, I venture the opinion that the machine shops haven't got started yet. There are lots of them yet to come. Not monster establishments with full lines of regular articles to make, with a routine business and printed catalogues, with stocks of patterns in regular use, with story after story full of fine tools and fine workmen; not such shops as these but little shops which will some day, under the management of boys now sweeping the shop, grow up and find their place. These little shops will have a certainty of nothing, and will do every thing.

* * * * The ambitious machinist sees at once that his "business" requires more money for a start than he can earn in a lifetime, and he wishes he had gone at the tinner's trade, so he could start business with a lump of rosin and two pounds of soft solder.

* * * * The machinist trade is all right. Men with nothing have finally got shops of their own, and it will continue to happen that way. A man some day learns that if he can't ride, he can walk. If he is not born to move, he can stand still. There are riding shops, and there are walking shops. I know something about these walking shops; in fact I was raised in a shop that was too weak and puny to creep well, and I saw it in full gallop before my term of apprenticeship was up.

* * * * If a man serves his time in a high-toned tip top shop, it will be a struggle for him to start the little shop which is to make his fortune. Still they do it, and I actually believe that the most successful owners are those who come from these good shops. The slouch from the rough little shop can start one of his own and feel at home, but if the business should grow in spite of him, it would probably get away with him, while the lordly chip from the big shop, if he can narrow his gauge to start on, is always ready for healthful growth.

* * * * There are two ways of starting small shops. One is to depend on your

superior skill and wit and mechanical reputation, and start right under the nose of the big shop you came out of. If you have luck you may absorb the big shop in course of years. If you don't have luck, they will absorb you. Such is the course of events when the small shop is started in a city or manufacturing neighborhood. Such shops generally start with the intention of making a certain thing, and depending on luck and management to bring other things into line.

The other way is to hunt around and find a place miles and miles and miles away from any other shop. The place must be located in the market center of some saw-mill country, or agricultural country, or sugar-mill country, or some machine-using section. The intention is to get the repairs of the surrounding section, do such odd new work as can be picked up, and finally get into the manufacture of the very machines you repair. In proper hands this plan is the sure road to fortune. But it is hard up-hill work, and takes lots of pluck and good judgment. Repair work in such a shop brings fabulous prices. There is no competition, and skill must be used to keep competition away. West of the Mississippi is the place for such shops to hunt for locations. Timber regions full of local saw mills, two hundred miles from a railroad, can be found out there.

The work will be repairs on the engines and machinery of these mills. You will pay big wages and must keep the men, for you will have none of the visiting brethren calling on you for work. You must carry stocks of necessary supplies, or learn how to get along without them. Such shops require more money than the little city shops, because you must have your own foundry and a few boiler tools, and must carry pipe and fittings and belting, and stock generally. You can't get such things inside of three weeks, and you need them every instant.

It might be thought that a railroad would be a convenience, but a railroad would spoil the whole game. It would bring your supplies quicker, but it would also bring them to your customer quicker, and would allow him to go to headquarters. When your shop gets going, talk railroad all you want to, but don't subscribe any money or do anything which will really bring a railroad, unless you have some jealous man to buy your shop the day the railroad comes.

* * * * In this little shop you will have a twenty-four inch cupola, and will work one moulder whom you will call the foreman of the foundry. He will mould, and make cores, and mud up the cupola, and break scrap, and charge, and clean castings, and, once in a while, will re-shingle the foundry roof.

You will have a lathe about thirty inches swing to take in, say twelve feet. This you will run yourself. You will have a small lathe, say twenty inches by six feet, and an upright drill not less than eighteen inches from drill to column. Two vises and one journeyman machinist, and an apprentice on the small lathe, and one blacksmith run the thing. You will learn the value of hand dies for screw cutting, and will do heavy chipping.

* * * * Your work will consist entirely of repairs at first, and you will cultivate cheek and learn how to charge for work. You will have one common pattern maker, and will learn to charge every customer for pattern making, whether you have the pattern on hand or have to make it.

You will sell to the stores country castings, such as fire dogs, sash weights and flat irons, and once in a while you will build some sort of a something for somebody, but generally you will do repair work, which you will find enormously profitable if you only charge enough. After a while you will find that your repairing has given you a complete set of patterns for a saw mill or a saw mill engine, and you will build some to order. You will make rough, ugly serviceable machines and sell them for about five prices. After a while you will get up a saw mill or engine, no better than anybody else's, but a little bit different, so you can call it your own. And thus the thing works up or down according to your management. Your real estate is given to you with a cash bonus to encourage the enterprise, and you become a curiosity and a power in the neighborhood.

One thing as a machinist you must tamely submit to. Your establishment will be called a foundry. You may call it your shop, or your machine shop, or your factory, or your works, but the people will call it "the foundry."

Your insurance will be ten per cent. per annum which you will pay without thinking it high.

* * * * Tylersville is a water-power town. It is a place of about twelve thousand inhabitants, and makes its living out of paper mills, wood working factories, woolen factories, agricultural implement shops, steam engine shops, and a general line of metal industries. Tylersville is the manufacturing suburb of a large city. Its water power is excellent, and is distributed by canals to about a dozen power centers, around which factories and shops are crowded.

McGuffy bought property at one of these power centers and started a boiler shop.

His shop was like all other boiler shops, part building, part shed, and part yard; and he made the usual racket, of course. Now it happens that the party, of whom McGuffy bought his lot, lives in the next lot. He is a quiet, refined and cultured professional man with a family, and with senses and nerves. He goes into court and prays for an injunction restraining McGuffy from doing any more riveting, unless he uses india rubber hammers; and he further asks for $5,000 damages done to real estate and ear drums. Five of his neighboring residents join him in the expense of this test case, and if it is successful, they will come in with prayers and claims, and maybe the same will be done by every resident who can hear McGuffy's hammers. This would include about half the residents of the town.

* * * * I spent yesterday in the Tylersville Court House listening to this case. The evidence on both sides seemed to be about the same, and indicated that boiler making was a noisy business, well calculated to annoy sensitive people. After the hearing of the testimony and receiving briefs, his honor took the matter under advisement, and I hope in my next letter to be able to say whether McGuffy may go on with his hammering.

* * * * I gathered from this case that the law of nuisances has been pretty well fixed and settled. The law has decided what constitutes a nuisance, and among other things is specified unusual noises.

The law also says that if one man produces unusual noises on his premises so as to interfere with his neighbor's happiness, his neighbor has grounds for legal action. It has been decided that a legal action may be taken against a boiler shop, no matter if the plaintiff or defendant was on the premises years before the other came.

The novelty of this case is in the existence of the water power, and it may be held that owing to the existence of these power centers, the infernal din of boiler hammers is a usual and appropriate noise, and that owing to the existence of these power centers with their appropriate din and clangor, the occupation of near property by a sensitve and delicate professional man is an unusual and inappropriate use of such property.

* * * * It must be allowed that to refined and sensitive people the din of a boiler shop is intolerable. Being intolerable it follows that the din's effect must be altered. Either the dinner or the dinnee must move. The one compelled by law to move is simply the most unfortunate. It is not the proper subject for a legal quarrel, but certainly is a question calling for the learned opinion of an impartial judge.

* *. * * * Very respectfully,

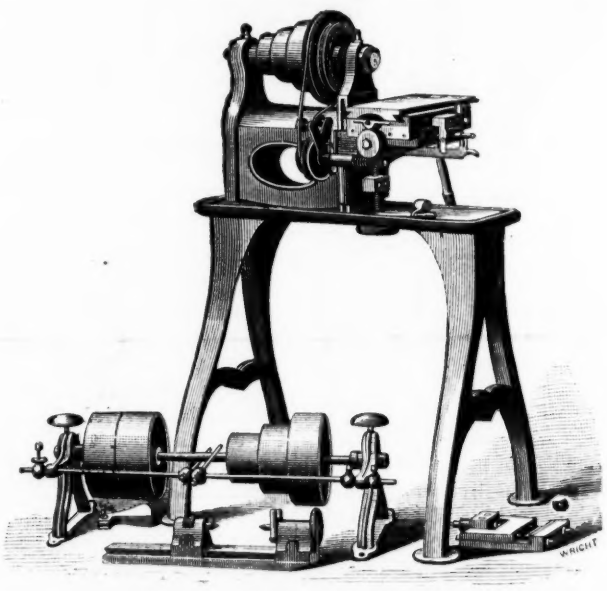
CHORDAL.

New Hand Milling Machine.

The new hand milling machine illustrated herewith, is well calculated for taking light milling cuts, and can be operated very rapidly. The box-shaped head is mounted on a planed iron table, with a groove around the edge to catch oil and chips. The cross slide may be adjusted 2¼ inches, by means of a screw with a square end for wrench, seen projecting in front. The screw that elevates and depresses the table passes down through the bed plate, and is operated by a hand wheel from beneath. Its vertical range is from the center to 4½ inches below. The steel spindle is 1 5/16 inches in diameter and 14 inches long, and has a ⅝ inch hole clear through it, tapered in front to receive the shank of the arbor. This shaft is provided with a three-speed cone pulley, whose diameters are 3½, 5, and 6½ inches, with 2 inch face. The feed has two changes. The boxes are made of composition, fitted with ample means for taking up wear. The table is 16 inches long by 4⅝ inches wide. The hand lever is linked on to the end of the table, and the feed so arranged that the table can be fed along until the feed throws out, and then the table can be returned by the use of the hand lever, or a weight (shown beneath the machine) can be attached to the lever, making it self-adjusting.

There is an adjustible stop, located in a T slot on the side of the table, and it can be easily regulated to the required length of feed. The extreme length of feed by hand or power is four inches. The vise used on this size machine is ¾ inch deep and 4 inches wide, and will open 1 5/16 inches with the steel jaws removed. The centers permit 3¾ inches swing, and will take work 6 inches long. The weight of the machine complete is about 360 pounds.

The machine is manufactured by E. E. Garvin & Co., 139 Center Street, New York.



NEW HAND MILLING MACHINE.

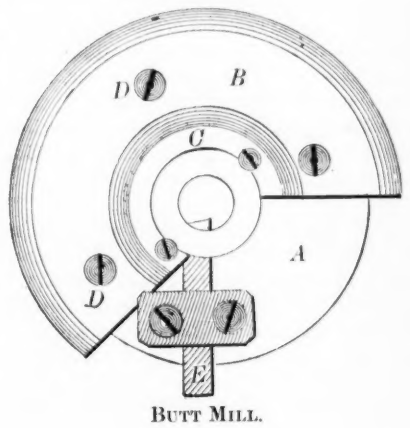
The Swiss Company, which constructed the Rigi railway, contemplate making a toothed-wheel railway up the Schneekoppe, the highest peak in Northern Germany. This is to be a branch of the Bohemian railway.

Letters from Practical Men.

AN ADJUSTABLE BUTT MILL.

Editor American Machinist:

In making a model some time since, I had occasion to use about 300 3/16" brass rivets, of various lengths, and of a shape of head very difficult, if not impossible, to find in the market. Not having any conveniences for upsetting the heads, and wishing them as strong as possible, I decided to make them from solid stock, which, with the aid of the tool for turning the bodies, shown in the sketch, we very easily did.



BUTT MILL.

The foundation of it was simply a cast iron drill pad of 2½" diameter, which was fitted to the tail spindle of a 9" hollow spindle hand lathe. There is a piece *B*, recessed a little on one side (and bored true in the center to receive hardened bushings *C*), which forms a sort of cap for the shank piece *A*, to which it is fitted and firmly secured by screws *D*. The tool or cutter *E*, is simply a piece of ¼" square steel suitably shaped to cut the material required. It is adjustable to size by sliding in a shallow seat, and is secured by a little clip over it, held by two machine screws.

I even went so far in making this one, as to put on some little extra finish, not but that it would have worked fully as well without, but, like Chordal, I "like to see things polished" a little, and feel more respect for them, both in use and while idle.

Yours respectfully,

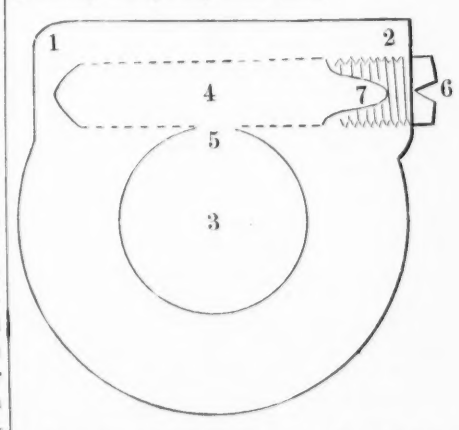
CHAS. S. BEACH.

Eagle Bridge, N. Y.

MORE OIL HOLES.

Editor American Machinist:

If there is anything that will annoy the ear of a mechanic, it is a rattling, wobbling, grinding, always dry loose pulley.



Now, since Mr. Coffin has broken the ice, in your issue of July 24th, I will tell of an oiling device I had made, which is herewith illustrated. On the side of the hub was cast a projection, (1—2) into which was drilled a hole (4) just touching the bearing (3 at 5) and passing on beyond it, but not through the hub. Into the end of the hole was fitted a screw (6) into the bottom of which was cut a slot, the object of which is to enable one to oil the pulley without taking the screw entirely out. This style of pulley has given the very best results, and one made two years ago now runs as smoothly as when made. It gets oiled about twice a week. I would say that there is no patent on it, and all are welcome to try its merits.

Respectfully yours,

HERBERT S. WILSON.

Battle Creek, Mich.

New Surface Planing Machine and Iron Frame Rip Saw.

In designing the "Eureka" Surface Planing Machine, illustrated on this page, the makers, Cordesman, Egan & Co., 246 to 250 West Front street, Cincinnati, Ohio, have aimed to squeeze a big machine into small compass, as a glance at its solid and compact proportions will show.

The machine will take a fine finishing cut, doing the smoothest work, or, by a few turns of the wheel, the bed can be lowered, and a cut $\frac{5}{8}$ deep in hard wood can be taken. The frame and bed are each cast in one piece, and especial credit is claimed by the makers for the manner in which the bed and frame are dove-tailed together, making the machine very stiff, and leaving the cut free from ridges. The boxes for cylinder and rolls are cast on the machine, making a very rigid and substantial bearing free from vibration.

The cylinder is of refined wrought iron with twisted journals, and the bearings are long and lined with genuine babbitt. A pressure bar goes on each side of the cylinder, thus insuring steadiness even when planing short or thin stuff. These pressure bars are self-adjusting, always regulating themselves to the various lumber being planed.

The process of changing the machine to different thicknesses is quick and simple, the bed being raised and lowered by a single hand wheel. The feed rolls and cylinder being in stationary boxes, are always the same, and when the bed is raised or lowered, a glance at an index on side shows the thickness to be planed, and requires no further setting.

The four feed rolls are extra large, the front one being fluted. The friction rolls in table are easily adjustable. The gearing is strong, and every device introduced to make a strong, reliable feed.

It planes from 1-16 to 6 inches thick, and either 18 inches or 24 inches wide. A counter shaft is furnished, if needed, and can be either placed on the floor, or under, as most convenient. The counter shaft has a flanged pulley on it to run to loose and tight on machine, thus stopping or starting the feed.

The machine is especially recommended by its makers for panel work, cigar box, pattern and mill work, box and planing mills, carriage and furniture factories, and smooth work generally. The pulleys are 10 inches by $5\frac{1}{2}$ inches face, and are intended to run at the rate of 900 revolutions per minute. Two sizes are made of this machine, $18\frac{1}{4}$ and $24\frac{1}{4}$ inches wide respectively, working in either soft or hard wood.

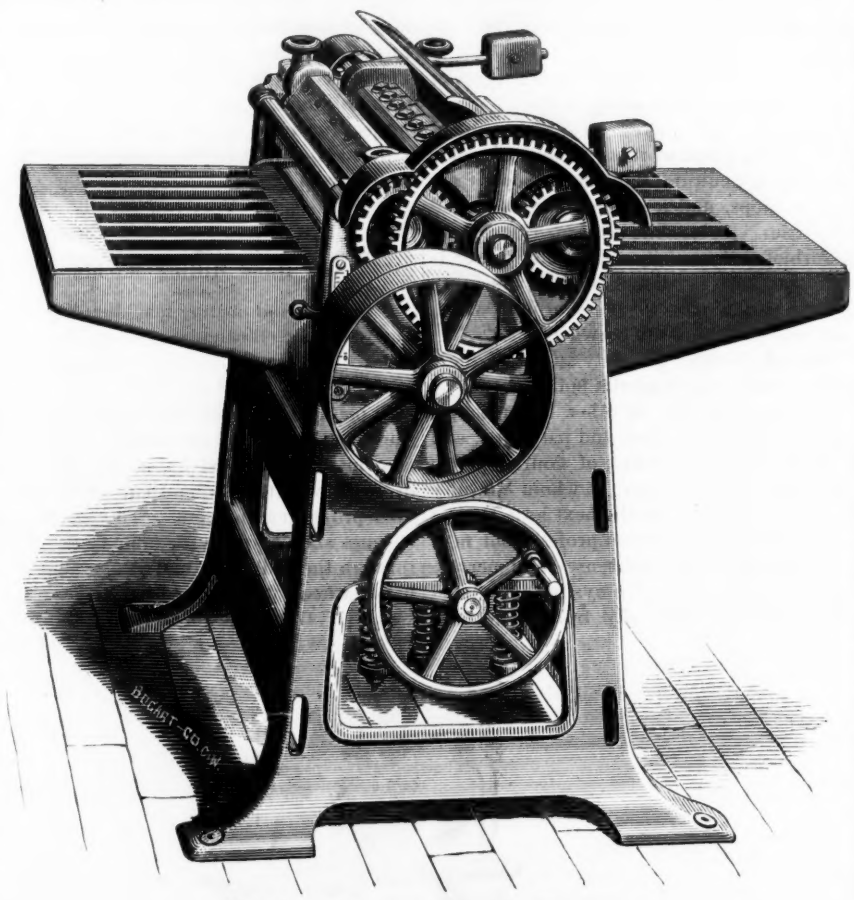
The Iron Frame Rip Saw, with patent adjustable fence, and hinged table, shown in the second illustration, is built by the same makers. The frame is of best quality cast iron, very strongly ribbbed, making a very stiff and strong support for the mandrel. An extra curved cross-piece is put in the center to strengthen the bearing for the mandrel.

The table is made of alternate strips of cherry and walnut, is extra long and hinged at one end, and can be raised or lowered by a raising screw at end, or can be instantly lifted up. A ratchet or rack, with a patent spring at its back, holds the table wherever wanted, without loosening or tightening any bolt. This will be found very convenient for oiling or interchanging saws.

The patent fence is another good point on this machine. It can be instantly angled to any point. An iron plate is let into the wood table for the fence to slide on, allowing it to have greater range of adjustment, and holding it firmly.

The connected boxes on mandrels have patent self-oiling boxes. Pulley on No. 1 saw is 4 inches in diameter, 5 inches face and is intended to run 2,700 revolutions.

LAUNCHING A BRIDGE.—In constructing a railway bridge over the river Ranee, in France, the engineer decided to build the bridge on the shore and launch it over the river. The bridge weighed, when it was complete, 2,600,000 pounds, its height above the river was 100 feet, and the span 314 feet. Twelve windlasses were used to draw the bridge into its place.



"EUREKA" SURFACE PLANING MACHINE.

Selecting a Foot Lathe.

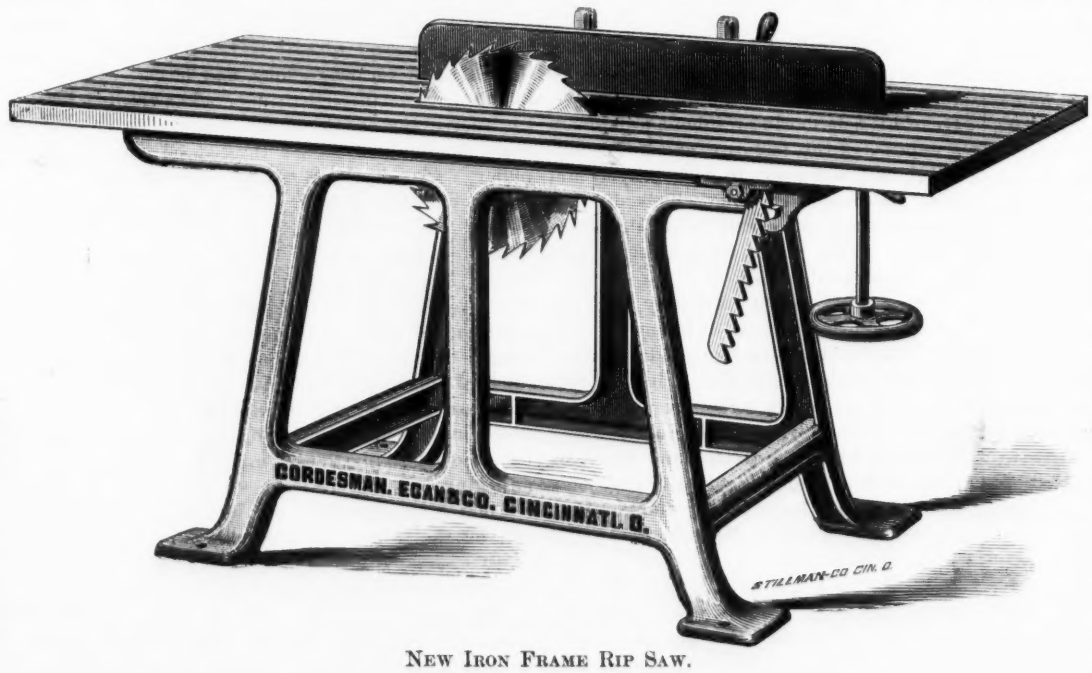
BY H. NORTON.

If one must or will have a foot lathe, the following considerations may prove valuable: The driving cone should be placed overhead and connected with the treadle by a light wooden rod or leather strap. This will give a longer belt than any other way—a matter of much importance. Make the smallest step of the driving cone nearly as large as the largest step of the driven cone. This will give the most power, and will drive fast enough for iron work. Mount the foot pad and lever upon a square shaft, or in some such way, so they can be moved lengthwise under the bed. This will be found the most convenient for turning pieces of different lengths.

A 12 inch swing, 4 foot lathe, is large enough, and should be as heavy and substantial in every way as if made to be driven by power. It should, of course, be back-geared. The following proportions might be observed: Front live-spindle bearing $1\frac{1}{2}$ by $3\frac{1}{2}$ inches; largest step of cone 7 to 8 inches in diameter; the outside track some 10 or 12 inches wide; length of carriage nearly twice the swing; cross-feed long enough to turn up full swing without resetting the tool.

The feed should run from 20 to 150 to the inch—the finest for turning steel, and the coarsest for the finishing cuts. The changes from fine to coarse should be easily made. It should be provided with gears to cut from 4 to 64 to the inch. The lead-screw is most conveniently thrown in by means of an open and shut nut; and the feed should reverse in the head, for this allows feeding both ways for right and left handed screw-cutting, and permits the throwing out of all gearing for filing and polishing. Make the bed wide and heavy, the carriage long, and the feed strong, for a stiff, strong machine, if well fitted, will do light and delicate jobs much better than a smaller one.

The back motion in screw cutting can best be done by reversing with treadle, which is soon learned, and is very handy and safe for some particular jobs, as cutting threads up to a shoulder, or for inside work. Perhaps the cheapest way to obtain such a tool would be to buy an engine lathe of some good machine-tool builder, and fit up the counter shaft and treadle, or have them made to order. The counter shaft should have a balance wheel weighing some 30 or 40 pounds. If one makes his own machine he will probably gain considerable experience, but like all experience it will be dearly bought. Such a lathe as I have described, if well made, and run by an able and willing man, will turn off a great deal of paying machine work—that is, light work, within its capacity.



NEW IRON FRAME RIP SAW.

The *Western Manufacturer* of July 15, 1880, says: One of the most interesting features of the census of 1880, will be the positive assurance it gives of the effect of development of manufacturing industries upon population. Towns and cities in which the mechanical industries have been especially developed, invariably show the greatest increase of population. Of course, there are cities in which other influences have conspired to largely increase their population, like Denver, and other towns in the new mining districts of the West, but those are the exceptions and are easily accounted for. On all ordinary theories the growth of Chicago in the last ten years seems almost phenomenal, but when we take into consideration the extraordinary growth of our manufacturing industries, the constant founding of new establishments and new lines of production, with the growth of those already established, we no longer wonder at the increase. But even this increase in the population of the city proper does not do justice to the growth of our productive industries which have latterly, to a very large extent, sought localities in the immediate suburbs just outside the city limits. Especially has this been the case in our southern suburbs, where a large number of very extensive establishments have been located within the past year. Near the northwestern limits, along the North Branch, north of the city limits, is another favorite locality, where a number of large manufacturing establishments are being located. Should there be no drawback to our reproductive industries, in the shape of unfriendly legislation, we may safely expect to see Chicago take the third place, if not the second, among the cities of the new world at the next national census in 1890.

There is a Dutchman who keeps a tavern in a little country town on the line of a certain railroad in Michigan, and who is the credulous victim of some of the railroad boys who stop to take lunch at his place, and, being quite talkative, tells his guests all the news that reach his ears from the mischievous railroad boys. One day, while conversing with a traveler, he remarked "Do you see dot feller across the sthreet?" "Yes; what about him?" "Veil, he vas a enshineer on de road vonce, but he got de grant bounce." "How is that?" "I dolt you all abodt it. You see he vars behint time, and he got oxidet, and he make de fire on von site of de biler, und de stheam all gone on that site and throw de enshine on de switch."

M. Charnay, the leader of the expedition recently sent to Central America under the auspices of the Governments of the United States and France (the expenses of which are to be largely borne by Mr. Pierre Lorillard), telegraphs that the Mexican Government has signed a treaty giving him all the privileges and facilities he needs in making explorations, and has appointed a representative to accompany him. He also reports from the City of Mexico, July 10, the discovery of an important archæological station, 4,000 metres above the sea, consisting of tombs, vases, skulls and other antiquities.

The Postmaster-General has decided to break up the practice of sending through the mails advertising cards of various sizes with one cent stamps attached. After October 1, no cards, except the regulation postal cards, will be transmitted at a less rate than three cents for each half ounce.

Horizontal Boring and Drilling Machine.

The machine, shown in the cut, is designed to bore and drill work in a horizontal position; its importance in a machine shop ranks next to the lathe and planer; in fact, for a great variety of work it is superior to a lathe, from the much greater convenience it offers in setting work, and from the fact of the boring bars being supported closer to the work than is possible in a lathe.

The spindle on which the cone pulleys are placed is made of cast iron, and is hollow from end to end, so as to admit the steel spindle which is placed inside of it, and which has a horizontal movement through it, besides being turned by it. Mechanics, at all familiar with the building of such an arrangement as this, will at once appreciate the great difficulty of making this spindle run perfectly true when traversing its different ranges. It is accomplished, however, by boring the cast iron spindle after it has been fitted, and is running in its own bearings.

The feeds for the spindle are obtained at the back end of the machine, by a system of gears that will feed it either backward or forward, as may be desired. It has three ranges of feed, operated by an internal clutch very readily changed from one to the other; as well as a quick return for the spindle by hand.

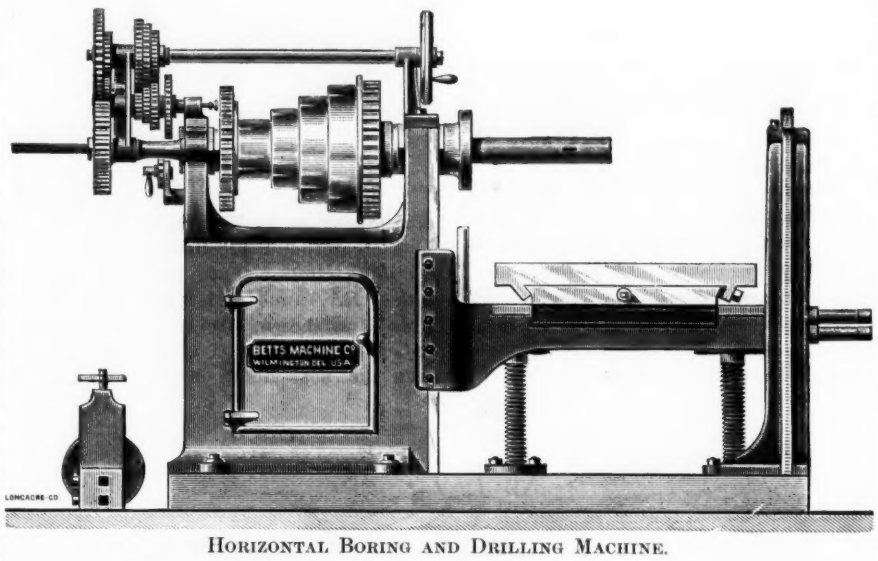
The work is secured to a table which is raised and lowered by screws and bevel wheels. The table carries a saddle which has a movement parallel with the main spindle; on this saddle is a cross table which has a horizontal movement at right angles to it. It will thus be seen that any range of work within its scope can be performed by one setting, by merely moving the table in the directions required on the work to be performed.

The operation of boring is with boring bars and cutters, the outer end of the boring bar being supported by a steady rest. The work is secured to the table, and does not move, but has the cutters fed through by the mechanism above described.

The steady rest can be removed from the machine, so as to admit all long work that requires drilling, and that would be inconvenient to put under an ordinary vertical drill; in fact, the design of the machine is such that horizontal drilling as well as boring can be done with the greatest facility.

A facing tool is also provided, that gives the machine all of the advantages of a facing lathe for many kinds of work.

It will readily be seen that this machine is adapted to a great variety of work. It is manufactured by the Betts Machine Company, Wilmington, Delaware.



Horizontal Boring and Drilling Machine.

A late issue of the *Railroad Gazette* has information of the laying of track on 38 miles of new railroad, making 2,228 miles thus far this year, against 1,035 miles reported at the same time in 1879, 791 miles in 1878, 710 miles in 1877, 846 miles in 1876, 457 miles in 1875, 727 miles in 1874, and 1,578 miles in 1873.

The Paradox Engine.

The purchaser of an ordinary forty or fifty horse power engine places it in charge of an engineer. Whether the engineer be good or bad, he may be supposed to know something about the care and repair of engines. This engineer's wages adds that much to the cost of the power, of course, but for large powers the proportion of this expense is so small, that no man would dream of doing without an engineer. The better the workmanship and material of the engine, the better results will the engineer get out of it. The engineer is supposed to possess some skill, and with something good to apply this skill to, the more profitable the result of his lessened labors.

In the last fifteen years the little steam engine has become an institution in the land. Hardly a village is so small as not to have a printer, or butcher, or cider maker, or some one using an engine from two to ten horse power, while the larger cities have them by the hundreds in every story of buildings, from cellar to garret. To fill the demand for these small engines, many large concerns have engaged in their manufacture, and we find in the market an infinite variety of them, from the crudest traps which will run at all, to the most delicate refinement in the way of steam engines.

While it pays well to employ an engineer for a forty horse engine, users of these small engines do not seem to think it proper to add an engineer's wages to the cost of four or five horse power. As a consequence, these small engines, in most cases, go into the care of some person with a hundred duties, a man totally unskilled in the keeping of machinery in repair or adjustment. The ability to keep up steam and water seems to be the main requisite. As a matter of fact it requires as much skill to adjust the connecting rod, or cross head, or valve, or governor, on a two horse engine, as on one of two hundred horse power. The man in charge of the little engine is not an engineer, or a mechanic, and it will not pay to employ one who is. Under such circumstances it almost seems that good material and nice construction is wasted on small engines, and it is even thought by some that the crudest of small engines in the market will give as good satisfaction as the finest, so long as unskillful men attend them. It is not bad material or bad workmanship, which disorders the engine. It is unskillful attendance, and this lack of skill seems to be essential in the use of small engines. Under such circumstances it is no wonder that small powers are often considered a nuisance, and that parties really needing small powers hesitate long before putting in a small engine.

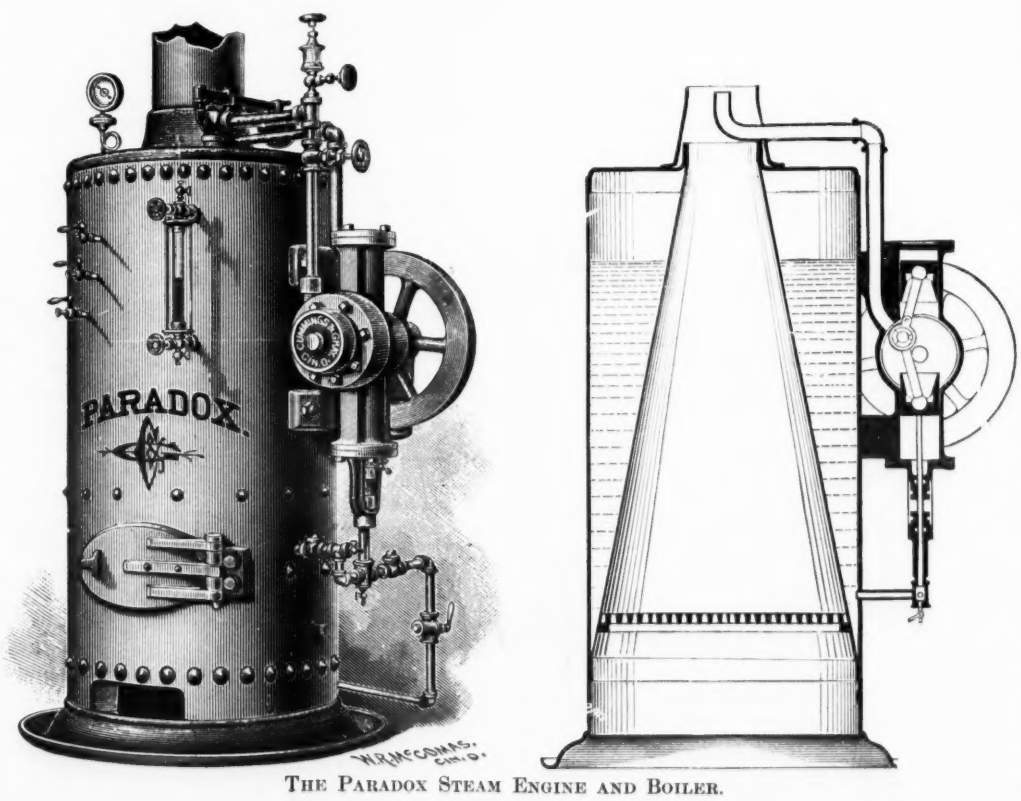
It was a knowledge of these facts which led Mr. George A. Gray, Jr., long superintendent of the Niles Tool Works, to the invention of the Paradox engine, which we illustrate herewith. In this peculiar machine the engineer has nothing to do with the engine, except to open and close the stop valve. He cannot set up boxes unskillfully because they cannot be set up, and do not need it. There is but one oil hole; the governor consists of one unadjustable piece; there is no eccentric and no valve gear, and no cross head. There is not a single key or set screw about the engine.

If steam can be hired, this engine without a boiler or pump may be fixed to the wall, out of reach of any man, and it will require no more attention than a common loose pulley. There is absolutely nothing about the engine which calls for attention. The maintenance of steam and water, which seems to be within the capabilities of men who cannot keep a common engine in order, is the only duty required of the engineer.

Adjusting boxes in this engine is rendered unnecessary, because the wear is constantly in one direction. In common engines, the wear being in two directions, the least lost motion produces knocking. There are two pistons, each single acting, and, of course, there is no "back pull" on their connecting rods. The accumulated wear of years produces no knock in this engine. The valve has no reciprocating motion, and, consequently, no lost motion. All the wearing parts are in steam, and are composed of a composition, which is lubricated by steam. The governor is on the back of the main valve.

The boiler is of the cone type, and no cast iron is used in its construction. The proportions adopted for the boiler have developed economical and steaming qualities which are surprising. The boiler stands on a closed base, which allows it to stand directly on a floor. The engines are also arranged, without boiler, to attach to a wall in case steam can be rented on the premises.

These engines are manufactured by Cummings & Gray, Cincinnati, Ohio, who will supply them to dealers only.



The Paradox Steam Engine and Boiler.

Russian Engineers.

The frigate Minin set out from Russia last autumn with an American engineer on board to assist the Russian staff. The latter were very good at theory, but woefully deficient of practice. At Aden the Russians began to think they could get on by themselves, and made matters so unpleasant for the American that he telegraphed to Russia to have himself recalled. Before he had left the ship forty-eight hours the engines broke down, and telegrams were sent after him urging him to come back. These, however, did not reach him till he got to St. Petersburg, where he refused to go back again unless the Admiralty doubled his pay and gave him a document signed by the Grand Duke Constantine, placing him above the engineering staff and giving him power to send back to Russia any of the engineers he chose. As he had helped to construct the engines, and knew more about their working than anyone else, the Russian Government agreed to his demands, and he left for the Pacific.

New Use for Nickel.

Gaspard and Bell have recently submitted to the French Société d'Encouragement several objects formed from pure massive nickel, obtained, not by electro-deposition, but by fusion and forging. Nickel possesses many properties that deserve attention from those engaged in industrial pursuits. For example, it is not liable to oxidation by atmospheric influence, nor under any ordinary circumstances. It is more infusible, malleable, and ductile than iron. These qualities, however, cannot be utilized, because it must be employed pure and under special conditions. If one thousandth part of magnesium is thrown into the nickel at the moment of fusion, then the metal will possess all the malleability that can be desired. It may be drawn, rolled, or welded, and may be worked in any manner in which iron can be worked.

Notes on Steel.

Steel merely hardened is hardest on the surface, while in steel that has been tempered the exterior is the softest. In the one case because the surface was cooled in advance, in the other because it was heated in advance. Steel which has rusted can be cleaned by brushing with a paste composed of ½ oz. cyanide of potassium, ½ oz. castile soap, 1 oz. whiting, and water sufficient to form a paste. The steel should first be washed with a solution of ½ oz. cyanide potassium in 2 ozs. water.

As the cyanide of potassium is a very dangerous poison, and as its fumes, when inhaled in sufficient quantities, will produce death, it should be handled with great care, and kept in a tightly corked bottle.

The Muscatine, Iowa, Oat Meal Mill is now shipping 130,000 pounds of oat meal to Glasgow, Scotland. It goes by rail to New York.

The Teeth of Spur Wheels—Their Correct Formation in Theory and in Practice.

BY PROF. C. W. MACCORD.

NO. II.—LAYING OUT THE TEETH—THE PITCH CIRCLE AND CIRCULAR PICTH.

If the line of centers of a pair of spur wheels be divided into two parts which are to each other in the same ratio as the numbers of the teeth, the circles of which these parts are the radii are called the *pitch circles*. And the first step in laying out a pair of wheels is to determine the radii and draw these circles. Suppose, for example, that the distance *CD*, between centers, in Fig. 11, is given, and it is required to make two wheels whose angular velocities shall be as 2 : 1. Divide *CD* into three equal parts, of which *AD* is one, then *AC* will measure two, and

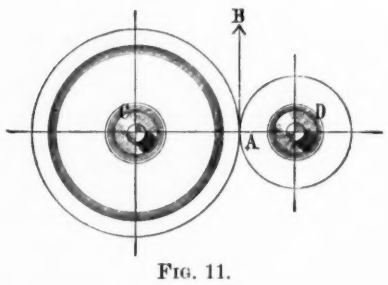


FIG. 11.

the tangent circles shown are the pitch circles. Evidently they can move in perfect rolling contact about their fixed centers; the linear motion *AB* is the same, whether we regard the point *A*, as belonging to one circle or the other. But one will not drive the other without the possibility of slipping, which would cause the velocity ratio to vary; hence the necessity of teeth.

The next step is to divide each pitch circle into as many equal parts as its wheel is to have teeth. We may give the smaller wheel any number we please, but the larger one must have twice as many in this instance. The *pitch* of the teeth is the length of the circular arc obtained by this subdivision. Since the larger circumference is twice the smaller, but is divided into twice as many parts, the pitch arc is the same in both wheels. Each of these arcs must contain a tooth and a space; hence we may say that the pitch is the distance between the centers or the corresponding edges of two adjacent teeth, *measured on the pitch circle*, not in a right line. This is sometimes called the *Circular* Pitch, in distinction from what is known as the *Diametral* Pitch, of which hereafter.

GENERATION OF THE TOOTH OUTLINE.

In Fig. 12, let *C* and *D* be the centers of the pitch circles *LM*, *RN*. Tangent to these at *A*, is a smaller circle whose center is *O*. Suppose all the centers to be fixed, then the three circles can move in rolling contact, with equal linear velocities. Set off from *A* the three equal arcs *AB*, *AE*, *AP*. Suppose a marking point originally fixed at *A*, in the circumference of the small circles; then while this travels to *P*, it must trace, with reference to *RN*, the curve *BP*, and with reference to *LM*, the curve *EP*. Now the relative motions of the circles are precisely the same as though the small circle had rolled upon the outside of *RN*, and upon the inside of *LM*, regarding these as fixed base lines; the curves are, therefore, an epicycloid and a hypocyloid respectively; and *AP* is their common normal.

If the tracing point go on to *P'*, the arcs *AP'*, *AE'*, *AB'*, being equal, the resulting curves *B'P'*, *E'P'*, are clearly but extensions of the first pair, and *AP'*, is their common normal.

We perceive, then, that the curves thus simultaneously generated are tangent to each other at some point throughout the generation; that the point of tangency is always in the describing circle; and that the common normal always passes through the fixed point *A*, upon the line of centers.

Consquently these curves are correct outlines for parts, at least, of teeth; if the curved lever *CE* turn, as shown by the dotted arrow, it will drive the other before it, the point of contact following the arc *P'PA*, until *E'* and *B'* meet at *A*; and as the common normal always cuts the line of centers at the same point, the velocity ratio will be constant.

FACE AND FLANK.

The epicycloid *B'P'*, which lies without its pitch circle, is called the *face;* and the hypocycloid *E'P'*, which lies within its pitch circle, is called the *flank*. Usually, each tooth has both; but wheels can be made, and sometimes used to great advantage, in which one of a pair has faces only, the other only flanks: we will consider this case first.

SIZE OF THE TOOTH.

This depends upon the pitch, for the pitch-arc must contain a tooth and a space, which might be exactly equal, were perfection in workmanship possible. Practically, the space must be a little wider than the tooth; the difference is called *back-lash*, and should be made as small as practicable. In drawing we may disregard it, and make the thickness of the tooth just half the pitch.

ARC AND ANGLE OF ACTION.

The angle through which a wheel turns, while one of its teeth is in contact with a tooth of another wheel, is called the

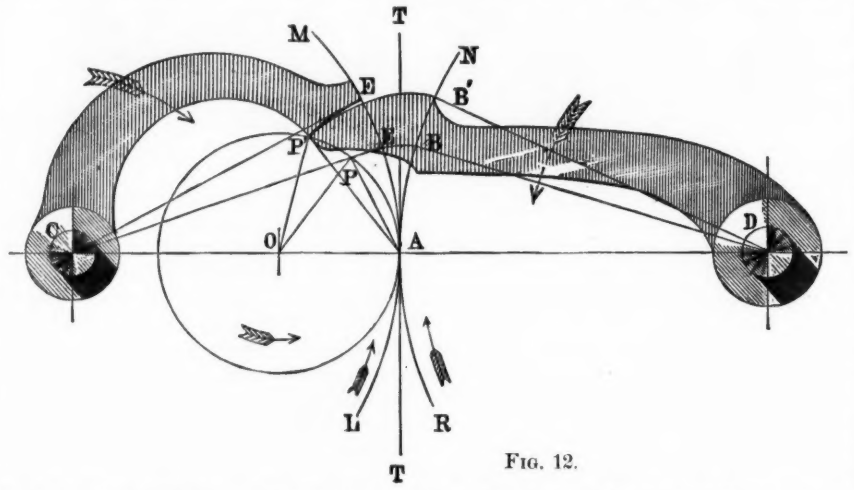


FIG. 12.

angle of action, and the arc by which it is measured is the *arc of action*. This latter must evidently be at least equal to the pitch-arc, in order that each tooth may continue in gear until the next one begins to act, and it should be considerably greater.

A PAIR OF WHEELS—LIMITING CASE.

In Fig. 13, the pitch and describing circle being drawn as in Fig. 12, let *AB*, *AE*, be the pitch arcs, and *AP*, an equal arc on the describing circle. Then the face for the tooth of *RN*, cannot be less than *BP*, since, if made, as shown, of exactly that height, contact is ending at *P*, at the very instant when the next tooth begins to act at *A*. Bisect *AB* in *H*, which gives the thickness of the tooth; and draw through *H*, a reversed face similar to *BP*. The conditions are purposely so chosen that this second face passes through *P*. The case is, therefore, a barely possible one; the tooth is pointed, and just high enough to continue in gear until the next one begins to

Fig. 13

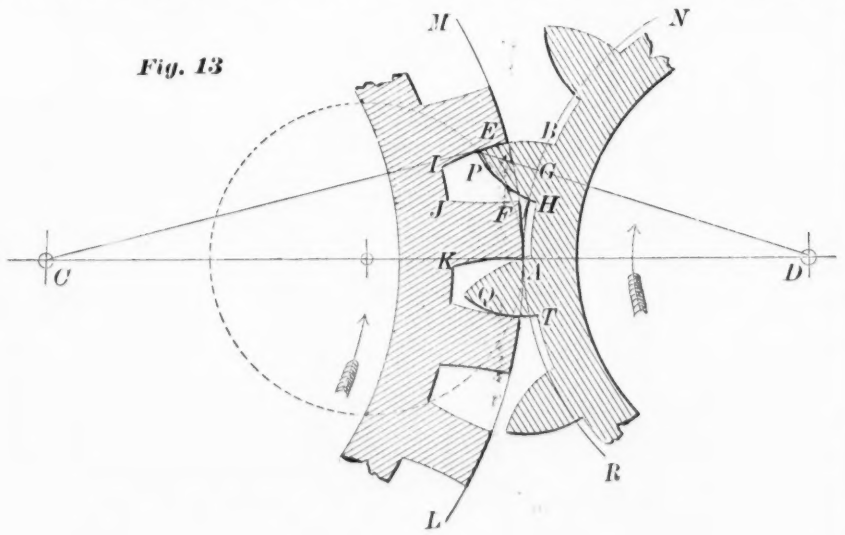
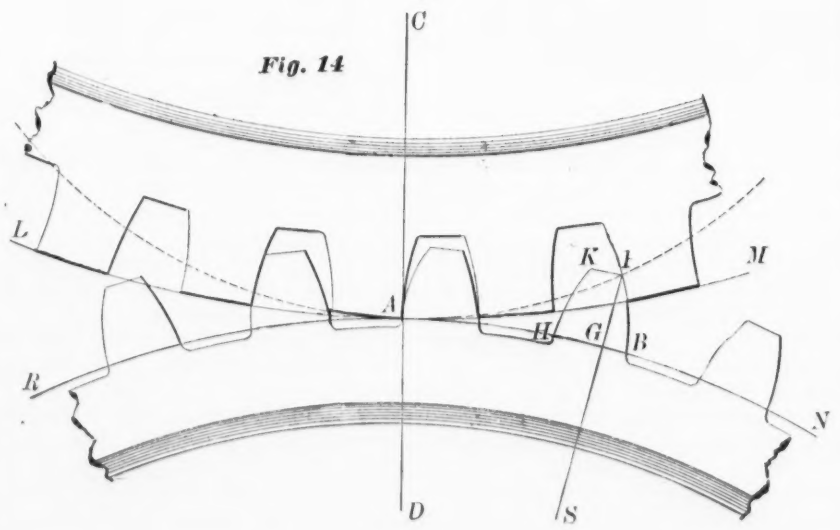


Fig. 14



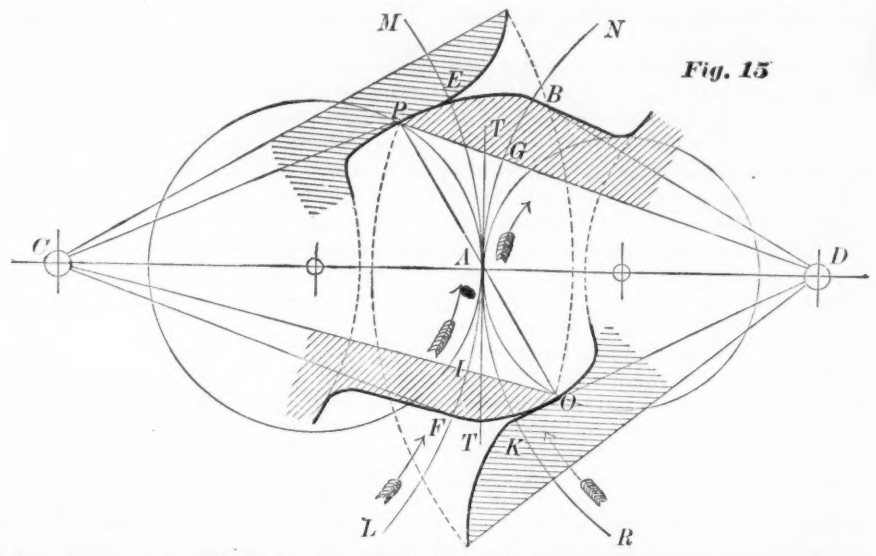


Fig. 15

act. We found that the face must be of the height *BP*, in order to secure this arc of action; drawing *PD*, which cuts the pitch circle in *G*, we find in this case that *BG* is just half the thickness of the tooth. Had it been greater, *GH* must have been less, so that the face through *H*, would not have passed through *P*, but between *P* and *G*, and the case would have been impracticable; it would then have been necessary to reduce the pitch and give both wheels more teeth. But if *BG* had been *less* than half the thickness of the tooth, we could either make the tooth higher, or give it some thickness at the top, as in Fig. 14.

The *acting* flank is *EP;* but in order to let the teeth of the other wheel pass, the hypocycloid is extended to *I*, making the depth of the space a little greater than *PG;* the difference is called *clearance*, and a similar provision is made in the other wheel by cutting in radially, as shown at *A*, *H*, *B*, a little below the pitch circle. The tooth of *LM*, is completed by bisecting the pitch-arc *AE*, at *F*, and drawing the curves *AK'*, *FJ*, etc., similar to *EI*.

A PRACTICAL CASE.

Limiting cases like the preceding are to be avoided in practice. A pointed tooth is bad, as being weak and liable to wear at the top. And even if it be not pointed, the angle of action should be greater, as otherwise, the least wear at the top reduces the face below the requisite height, which affects the velocity ratio. A reasonable case is shown in Fig. 14; the arc of action is 1½ times the pitch, and drawing the radial line *PS*, we find *BG* much less than ½ *BH*, thus giving the tooth a thickness *PK*, at the top.

APPROACHING AND RECEDING ACTION.

In Figs. 13 and 14, the action takes place wholly on one side of the line of centers. If *RN* be the driver (the directions being as shown by the arrows) the action begins at *A* and ends at *P*, the point of contact continually *receding* from the line of centers; in which case *AB*, *AE*, are called *arcs of recess*, or of receding action. If *LM* drive (in the opposite direction) the action begins at *P* ending at *A*; the point of contact is always *approaching* the line of centers, and *AB*, *AE*, are then called *arcs of approach*, or of approaching action.

It has been found by experience that the friction is greater and more injurious in the latter case than in the former; hence when such wheels are used, the one with faces only should always drive. But even then, there is one drawback, which will be seen by reference to Fig. 12. The longer the arc of action, the longer the face of the tooth, and the greater the *obliquity* of the line of action, that is, its inclination to the common tangent *TT*, of the pitch circles. The pressure as well as the motion is transmitted in this line, and the greater its inclination to *TT*, the greater will be the component of pressure in the line of centers, tending to cause friction in the bearings.

Consequently such wheels are better suited for use in light mechanism where the teeth can be made small and numerous, and smoothness of action is important, than for the transmission of heavy pressure.

TEETH WITH BOTH FACES AND FLANKS.

By giving faces and flanks to the teeth of

each wheel of a pair, we can secure a given angle of action with shorter faces, consequently with less sliding and less obliquity of action. Also, the action will take place partly before and partly after the point of contact reaches the line of centers. If a wheel is both to drive and to follow, the arcs of approach and recess may be made equal; but if one of a pair is always the driver, it may be desirable to make the arc of recess the greater, in order to reduce the amount of the more injurious friction.

The construction is shown in Fig. 15; all that relates to the face *BP* for *RN*, and the flank *EP* for *LM*, is precisely the same as in Fig. 13, and the lettering being so far made to correspond, no further explanation is needed. To complete the teeth, another describing circle is used, on the opposite side of the pitch circles, which generates the face *OF* for *LM*, and the flank *OK* for *RN*. If we assume the arc of action on that side of *CD*, as *AF* or *AK*, the possibility of securing it with a given number of teeth is at once ascertained by making the arc *AO* equal to *AF*, and drawing *OC*, cutting *LM* in *I*: if *FI* be *less* than half the thickness of the tooth as required by the pitch, or *equal* to it, the construction is possible, the tooth in the latter

Fig. 17

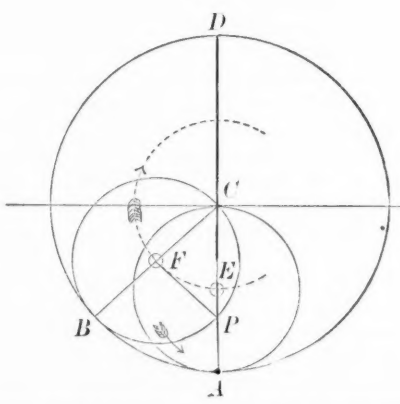
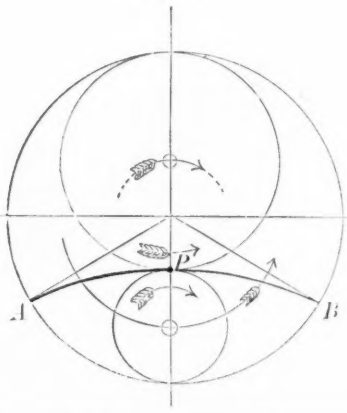


Fig. 18



event being pointed; if greater it is impracticable. If it be found feasible, we have only to draw the epicycloid *OF*, which joined to *EP* completes the outline of the tooth for *LM*, and the hypocycloid *OK*, joining it to *BP*, which finishes the outline of the tooth of *RN*. That is to say, these are the whole of the *acting* outlines; the flanks must be extended to a greater depth in order to give *clearance*, as already explained.

The operation will be readily seen; as in the diagram the acting side of a tooth of each wheel is drawn in two positions. Supposing *RN* to drive, the action begins at *O*, the driver's flank pushing the face of the follower, and the point of contact moving in the arc *OA*, until *K* and *F* meet at *A*.

The face of the driver then urges the follower's flank, the point of contact now traveling in the arc *OP*, and at *P* the action ends.

We see, then, that the angle of approach depends upon the length of the follower's face, and the angle of recess upon that of the driver's face; and if these lengths be assumed or given, those angles are readily found,—as for instance, had the length *KO* been assigned, it is only necessary to strike an arc about *C* with radius *CO*, which, cutting the describing circle in *O*, gives *OA* the length of the arc of approach, which is then to be set off on *LM* and *RN*, as *AF*, *AK*.

A Practicable Example.

The diagram, Fig. 15, is drawn without regard to practical proportions, in order to make the construction clear; but in Fig. 16 we have shown a feasible case; the cut is half size, and the conditions are as follows:

Distance between centers, 27 inches.

Wheels to have 63 and 45 teeth, the smaller to drive.

Angle of action to be $2\frac{5}{8}$ times the pitch.

Angle of recess to be one-third greater than the angle of approach.

We have, then, 63:45::7:5, $7+5=12$, $\frac{27}{12}=2\frac{1}{4}$, $2\frac{1}{4}\times 7=15\frac{3}{4}$, $2\frac{1}{4}\times 5=11\frac{1}{4}$, for the radii of the pitch circles. And $2\frac{5}{8}=\frac{21}{8}$, which is to be divided into parts in the ratio of 3:4; whence, $3+4=7$, $\frac{21}{8}\div 7=\frac{3}{8}$, $\frac{3}{8}\times 3=1\frac{1}{8}$ times the pitch = angle of approach, $\frac{3}{8}\times 4=1\frac{1}{2}$ times the pitch = angle of recess.

INTERCHANGEABLE WHEELS.

Inasmuch as the face and the flank which act in contact are generated by the same describing circle, it makes no difference whether the diameter of the one which traces the other face and flank be the same or not, in laying out a single pair of wheels; and in Fig. 15 the describing circles are of different diameters. But for the very reason just stated, it is clear that if we wish to make a number of wheels, any one of which will gear with any other one, we must use the same describing circle for all the faces and all the flanks.

SIZE OF THE DESCRIBING CIRCLE.

In making such a set of wheels, the question at once arises, how large shall the describing circle be? This depends upon a property of the hypocycloid, illustrated by Figs. 17 and 18. In Fig. 17, the describing circle is half the size of the base circle, and the line traced by the point *A* is merely the diameter *AD*. For after rolling till the point of contact is *B* (taken at pleasure), the describing circle cuts *AD* in *P*, its center meantime going from *E* to *F*. Draw *BFC*, and *PF*; then the angle *ACB* is half the angle *PFB*, but the radius *AC* is twice the radius *BF*, therefore the arcs *AB*, *PB*, are equal. In Fig. 18, the point *P* will trace the curve *AB*, by rolling in one direction, if we regard

Fig. 19

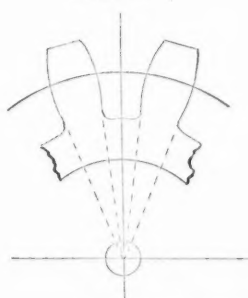


Fig. 20

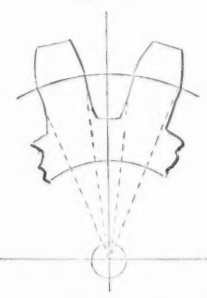
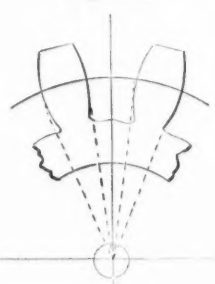


Fig. 21



it as in the circumference of the smaller circle; but if the same point be carried by the larger describing circle, it will trace the same curve by a rolling in the other direction. If then in any case the describing circle be half the size of the pitch circle, the flanks will be *radial*, as in Fig. 19; if it be less, they will spread out toward the root of the tooth, giving a stronger form, as

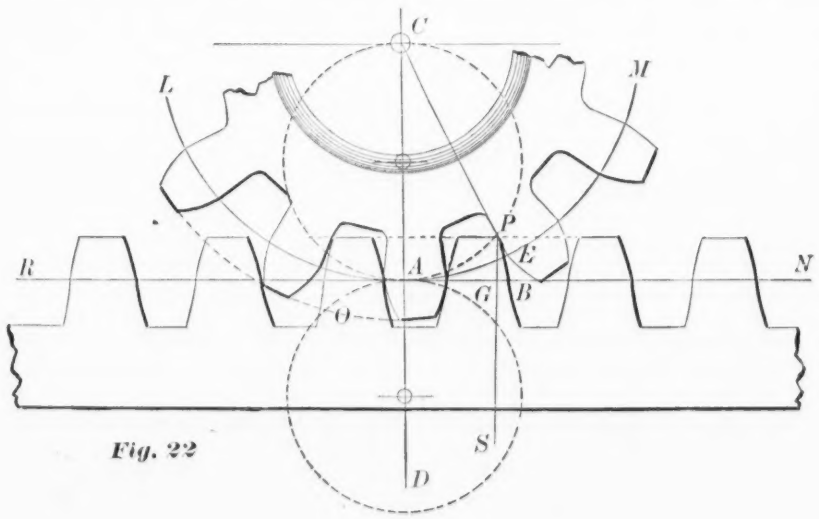


Fig. 22

in Fig. 20; but if greater, the flanks will curve in toward each other, as in Fig. 21, whereby the teeth become weaker and difficult to make.

From this, the safe practical deduction is, that the describing circle for a set of wheels should not be of more than half the diameter of the smallest wheel; and in laying out a single pair, two describing circles, each of $\frac{3}{8}$ the diameter of its pitch circle, give good practical forms to the teeth for general purposes.

Still, the face is shorter, and the obliquity of action less, for a given arc of action, the larger the describing circle; so that for very delicate mechanism it is possible that the gain from these causes would sometimes render it advisable to use teeth of the form shown in Fig. 21. They may be much strengthened by the use of large fillets at the junction of the side and bottom of the space, which is quite admissible, since the *acting* depth of the flank is comparatively small, as has been shown.

RACK AND WHEEL.

A *rack* is simply an infinitely large wheel. The curvature of a circle diminishes as the radius increases, and disappears when the radius becomes infinite; so that the *pitch line* of a rack is only a straight tangent to the pitch circle of the wheel with which it works, and the line of centers become a perpendicular to this pitch line, through the center of the wheel.

The rack will travel through a distance equal to the circumference of the pitch circle of the wheel during one revolution. The pitch of the rack teeth, therefore, is found by rectifying the pitch arc of the wheel, whatever that may be, and setting off that length upon the pitch line.

The construction is shown in Fig. 22. We have here shown the two describing circles as of the same size, and it is clear that if the same circle be used to generate the faces and flanks of a set of wheels, any one of them will gear with the rack if the pitch be also the same.

Evidently both faces and flanks of the rack teeth are cycloids, being generated by the rolling of a circle upon the pitch line. If the length *B P* of the face, be assumed or given, a line parallel to *R N* cuts the generating circle in *P*, thus determining *A P*, to which *AB* must be made equal, and fixing the part of the action which will take place on the right of *CD*. Or if *AB* be assigned, we make *AP* equal to it, thus ascertaining the necessary length of face. In either case, *PS* is now to be drawn perpendicular to the pitch line, which it cuts at *G*, and as in the preceding constructions *BG* cannot be greater, and should be less, than half the thickness of the tooth as determined by the pitch. The part of the action, which will take place on the left of *CD*, depends upon the length of the face of the wheel tooth, and is ascertained as in the cases previously explained.

SIEMENS' ELECTRIC FURNACE.—This appliance for the melting of refractory metals, such as platinum, iridium, steel, &c., has been exhibited to the Royal Society of London. The positive electrode, which was made of iron, entered from below the crucible containing the metal to be melted, whereas the negative electrode, which was a rod of carbon, was attached by means of a lever to a solenoid regulator. The crucible was surrounded by charcoal contained in a copper vessel, to prevent loss of heat, and so intense was the heat accumulated, that in about twenty minutes two pounds of broken files were completely melted. The arrangement was such that it may easily be applied on a large scale. Electric fusion has the great advantage of entirely excluding the atmosphere, and consequently the products of combustion, from the substance in the crucible.

The New York Evening Post has the following item about empting the water from the Hudson River Tunnel shaft: "A curious thing about emptying the water from the shaft was the working of a pump under water. One of the shaft pumps was a Deane double-plunger mine pump of small size, with an ejecting capacity of four hundred gallons a minute. It had, of course, been submerged from the time of the disaster, which occurred on Wednesday. On Sunday steam was admitted to this pump while it was yet under water, and, somewhat to the surprise of those who witnessed the experiment, it worked without fault. The fact suggested the idea that the pump might have been set at work long before, for, if it would work submerged three feet, it might have worked just as well when it was covered with thirty feet of water."

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NEW YORK, AUGUST 14, 1880.

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Relative Growth of Cities and Towns.

One of the most interesting studies connected with the recent census, is the relative advance in the population of the various cities. Excluding from the contemplation of this article, with one exception, the cities whose percentage of growth in the last 10 years has been under 50 per cent, we have the following interesting but incomplete table, a few of the figures being estimated.

CITY.	Pop. 1880.	Pop. 1870.	Growth.	Per Ct. of Increase.
Atlanta, Ga	45,000	21,789	23,211	106
Camden, N. J	41,714	20,045	21,669	108
Chicago, Ill	502,940	298,977	203,963	68
Cedar Rapids, Ia	10,176	5,040	5,136	100
Chester, Pa	23,000	9,485	13,515	142
Cleveland, O	157,946	92,829	65,117	70
Columbus, O	51,337	31,274	20,063	64
Detroit, Mich	119,700	79,577	40,123	50
Danbury, Conn	11,500	6,542	4,958	75
Denver, Col	34,000	4,759	29,241	614
Grand Rapids, Mich	32,037	15,530	16,507	106
Indianapolis, Ind	73,150	48,244	24,906	51
Joliet, Ill	11,000	7,263	3,737	57
Kansas City, Mo	56,964	32,260	24,704	76
LaCrosse, Wis	16,054	7,785	8,269	106
Meriden, Conn	19,108	10,495	8,613	81
Milwaukee, Wis	130,000	71,440	58,560	81
Minneapolis, Minn	45,000	13,066	31,934	244
Nashville, Tenn	43,377	25,865	17,512	68
Omaha, Neb	30,605	15,440	15,165	98
Pawtucket, R. I	19,538	6,619	12,919	195
Pittsburgh and Allegheny	232,355	139,416	92,939	66
Providence, R. I	104,410	68,904	35,506	51
Paterson, N. J	58,631	33,597	25,052	74
Racine, Wis	16,500	9,880	6,620	67
St. Joseph, Mo	35,000	17,565	17,435	99
San Francisco, Cal	227,350	149,473	77,877	52
St. Paul, Minn	40,000	20,030	19,970	99
Toledo, O	53,635	31,000	22,635	73
Wheeling, W. Va	31,000	19,280	11,720	60
Washington, D. C	160,000	109,199	50,801	47
Waterbury, Conn	22,000	10,826	11,174	103

The causes that have produced the real or apparent growth of American cities and towns cannot be traced according to any consistent rule. Many of the larger cities, especially, whose rate of growth has not been such as would give them place in the foregoing table, have made the increase that stand to their credit in the recent census, more largely through annexation of the surrounding country than through any other cause. Suburbs, that have no real or tangible connection with the large cities near which they happen to lie, have been ruthlessly annexed, by this means giving the latter the credit for two or three village inhabitants for every city denizen, whose business or property interests are in the city, but whose home and place of voting are located in the suburban town. But the gain by annexation is less noticeable in the case of cities showing a high percentage of increase.

Also, in some of the cities, showing a lower rate of increase than is found in the above table, the gain largely represents accessions of unskilled laborers. Almost invariably the higher percentages shown in the table refer to cities distinguished for growth in the higher mechanic arts.

Again, some of the cities on this list show a growth attributable more to location or situation than to any other single cause. Kansas City, St. Joseph, Denver, Minneapolis, and St. Paul, are notable examples of this class. The immense immigration that is flooding the fertile plains of Kansas, Colorado, Minnesota and Dakota (the young State of Kansas having now a population of over one million) involves a corresponding growth of the receiving and distributing centers of business tributary to these States, and to which these new States are tributary. Each of these cities in becoming the business depot for a territory, almost imperial in extent, fills up with a population far more mercantile than mechanical in its character. Of the five cities named in this category, Minneapolis, more than any other may fairly lay claim to the title of manufacturing city, owing to the enormous milling interests which have there taken advantage of her magnificent water power. Kansas City, in becoming a pork killing center, may likewise claim to be something more than a mere merchandise depot.

The two southern cities named in this list, Atlanta and Nashville, while differing somewhat in history, present substantially the same general aspect in their mode of growth. Both were war centers, the one being almost destroyed, and the other greatly crippled by the ravages of war, and both have risen from an exceptionally low plane of population and enterprise to a very respectable rank among cities. But in turning especial attention to manufactures, the former is as certain to surpass the latter, in all the elements that make statistics of population valuable, during the next decade, as she has in the ten years just closed.

It is not given to every city, or to many cities, to advance largely in commercial importance, while making a heavy increase of population through the growth of manufactures. Commerce may, and does, attract, not only inactive wealth, but active capital. But manufactures attract, what is better than capital, the skill and labor that make capital productive, and stimulate cities by peopling them. Of this class of American cities, Chicago is the greatest exemplar, with Indianapolis, Cleveland, Detroit, and Toledo, following her lead.

The kind of manufactures that has more especially contributed to the growth of each of the manufacturing cities named in the foregoing table is also a pleasant study.

And the fact may be noted that the special impulse of population in each has been mainly helped by one, or at most two or three departments of manufacture in most of these cases. Thus in the table, Pittsburgh heads the list of cities making iron manufacture a prosperous specialty. Chester varies the iron programme by devoting herself to the building of iron ships. Cleveland and Columbus run largely to the heavier branches of iron manufacture. Wheeling makes nails for a living. Cedar Rapids ships oatmeal heavily to Scotland, and spends her superfluous strength in packing pork. Danbury makes hats. The present statistics leave us in doubt whether or not the convict laborers in her prison swell the total for Joliet; but whoever attempts to rival her prison contractors, with their gangs of convicts working on leather manufactures at less than the cost of their keeping, will need both a stout heart and a long purse. Meriden runs largely to plated ware and similar light branches. Milwaukee makes beer for the world, and doubtless drinks her own share of what she makes. Providence chops out jewelry of all grades and prices by machinery, excelling also in machinery, tools and the various branches of iron manufacture. Grand Rapids is essentially a woodworking town. Paterson owes much to her silk mills. Racine dotes upon her manufactories of agricultural implements, while brass supplies Waterbury and Washington with their chief stimulus. In the one case the brass of the mechanic arts is relied upon; in the other, the brass of the politician supplies every need.

To what precise causes we may attribute the growth of San Francisco in population, during the past decade, it is not easy to say, when it is considered that the entire Pacific slope, upon which the city necessarily depends, contains a population but little, if any, greater than that of New York city. Most probably her relations to the mining interests of the Pacific slope, like Falstaff's relations to wit, are the moving cause, not only of her growth in population but of her gains in commercial importance as well. She herself mines little and manufactures less, but she is the cause of both mining and manufacturing in other centers.

The observer, who is half statistician and half philosopher, may find a still more fertile field in noting the ins and outs of population in the hundreds of towns and cities whose per-centage of growth falls below that contemplated in this article. Next to knowing where the people live, it is a curious thing to note the various threads of circumstance, whose meaning is made apparent in the results of a national census.

One Way of Running a Newspaper.

Noting a suspiciously familiar flavor in an article entitled: "The Model Foreman," printed in the July issue of a scientific-mechanical exchange, an accurate comparison with the editorial of similar name in the AMERICAN MACHINIST of May 22, 1880, from which it had been cribbed without a word of credit, proved that the two articles only differed from an eloquent statesman's description of the American states, in that they were one, and that one of the two was divisible. The first part of our editorial had been omitted, but the remainder was appropriated verbatim, without a word of acknowledgment.

From this promising beginning, further and more critical examination of the journal in question, than is our wont, developed the announcement that its advertising rates have been "reduced to meet the times," a statement of fact not without interest to advertisers, such as those in the AMERICAN MACHINIST, who get happy over an advance in rates regularly two or three times a year.

Noting the frequency with which either the name of the publisher or the paper, appeared in the advertising pages, only a little arithmetic was required to show, that, in addition to the space ordinarily reserved in all newspapers as a publisher's column, the publisher had taken advantage of the "reduced rates" above named, and driven a lively bargain with himself, in a journal ostensibly devoted to the interests of the scientific mechanical public.

Out of over 20 separate advertisements, covering 111 inches of advertising space (or more than 3⅓ pages) thus devoted to the publisher's use, a pretty fair division seems to have been made between advertisements of the paper itself, of machinery, tools and instruments for sale by its publisher, presumably as a feature of journalistic speculation, and of books for sale by him, apparently as a dealer. These books relate to all sorts of topics, the great majority evidently *not* being reprints from his own columns. It is not every newspaper that can boast of a 3⅓ page advertiser at prices "reduced to meet the times!"

It is to be hoped so shining an example will not be lost upon those obtuse editors and publishers, who will insist upon putting into their columns original articles that the public want to read, and of making their advertisers pay for the space they occupy at rates steadily advancing as their journals grow in circulation and influence.

Summer Meeting of the Mining Engineers' Society.

The Lake Superior Meeting of the American Institute of Mining Engineers this summer promises to be very pleasant, as well as profitable in acquiring professional information. The committee having the matter in charge, of a two weeks' excursion to the mining regions, have made arrangements for members living in the East to leave New York on Friday the 20th of August and reach Chicago next day, remaining there over Sunday. They will there be joined by members from other sections, and on Monday morning the party will leave Chicago on a special train reaching Marquette, Mich., the same evening. The circular issued, under date of July 24th, announces that arrangements have been made to have a steamer meet the party at Marquette, on which the members, and ladies accompanying them, will reside during their stay in the Lake Superior Regions, and on which excursions will be made to various points on the lake, including the copper regions, Thunder Bay, Silver Islet, and, *via* Sault St. Marie and the Straits of Mackinaw, into Lake Michigan.

The Committee give notice that they are not prepared at the present time to give further details, but the meeting and excursions will be so arranged that the members can reach New York on their return not later than Saturday, the 4th of September. Also that further details, as to route from New York, place of entertainment in Chicago, rates of fare, subsistence in the lake regions and the details of the excursions will be given in a subsequent circular.

The whole programme appears to be well prepared, and doubtless every part of it will be thoroughly enjoyed. Those members (including ourselves) who belong to the too-busy-to-get-away club will take pleasure in listening to particulars of the good time experienced by those who participate.

Quixotic Iron Manufacturers.

About the first of June the iron workers in the rolling mills of Philadelphia had a disagreement with the mill owners about the price paid for iron puddling. This led to a general strike, which was pertinaciously maintained for seven weeks, when the iron manufacturers held a meeting, and, after indulging in resolutions complimentary to themselves and derogatory to the Amalgameted Association of iron and steel workers, issued what purported to be a strong address to the iron workers in the rolling mills in that city offering them a "sliding scale" and considerable advice. In that address (which was signed by six firms and companies owning rolling mills) occurs the following bold declaration, which in the light of their subsequent action, would have done credit to the redoubtable Don Quixote himself. "We therefore declare that we will not hereafter employ any puddler, heater, roller or workman of any kind who belongs to any union, and who pledges himself to conform to rules in opposition to our interest." Like the piano manufacturers of this city who, three or four months ago, started a fine scheme to obtain a large amount of free advertising, they formed a union among themselves to regulate the wages of their workmen, and immediately opened hostilities against the latter, because they belong to a union having the same object. Before obtaining employment in the mills workmen were asked to sign articles agreeing to the manufacturers' decision of not employing union men. As soon as presented the workmen rejected the mill owners' terms of employment. The result was as might have been expected. The workmen refused to abandon their union, and in a few days the manufacturers backed down and employed them at higher rates than previously offered, without any exactions as to their connection with a trade union.

This is but one of many instances in which attempts to crush out a trade union have resulted in a sore defeat. If these combinations are wrong in principle among workmen, they are also wrong among employers. The iron workers' union had caused serious trouble to mill owners in Philadelphia, having made demands which seemed to the latter unjust and unreasonable. Instead of making a fair effort to convince the unionists of their rapacity, by combating them with solid arguments, the mill owners proceeded to meet unreasonable demands by others of the same nature. By so doing they have contributed to strengthen the iron workers' union which, elated by recent successes in Pittsburgh and other localities, as well as in Philadelphia, is likely to take advantage of its power and make more trouble for the manufacturers.

In our Questions and Answers department, "L. S." asks us "to name some creeks or wells in this country where wood may be put in and changed to stone." We are acquainted with some localities where the water is said to possess these wonderful properties, but they are too closely allied with legends that bear little if any tangible evidence of the truth of these representations. Will our readers who are acquainted with these localities please furnish us with some positive information in regard to the petrifying of wood, by placing it for a definite length of time in certain waters?

In our issue of July 31, we published a brief account of an accident to a locomotive which should not have appeared as it was written, but was overlooked in the hurry of getting ready for press. It is not our custom to insert anything without careful examination, but as about half our force was away on summer vacation, that issue of the paper was prepared in too much of a hurry. The paragraph should have said the parallel side rod was broken—not the connecting rod. The broken rod was taken off, also the side rod upon the other side, and the engine proceeded, driven by the connecting or main rods attached to the main driving wheels—no small wheels used. The engineer had no "companions" other than the fireman.

Questions and Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common sense methods.

(1) J. F., Bronxville, N. Y., asks: 1. Can a vacuum be formed over 15 lbs pressure per square inch? *A.*—A vacuum has no pressure in itself, but a perfect vacuum would sustain an atmospheric pressure of 14.7 pounds per square inch, at about the level of the sea. See answer to question (3) in our issue for July 24, 1880. 2. Is a bolt strengthened by drilling a small hole through the center lengthwise? *A.*—The tensile strength of a bolt or a piece of any other metal is decreased by removing a portion of its section. A bolt that is subjected to continual blows, or sudden vibrations will be less liable to break, if it has a hole drilled lengthwise through the center and made large in proportion to the tensile strain to which it is subjected. A solid bar of iron will in vibration fracture at the center first, and by moving the center the vibrations have no place to concentrate. 3. Must an engineer have a license to run a stationary engine in a country town? If so, where can it be secured or from whom? *A.*—A license is not required to run a stationary engine in country towns. The license system has only been adopted in some cities.

(2) W. S. E., Boston, Mass., asks: Will you kindly inform me how I can demagnetise calipers, drills and other tools, which have become magnets from use upon electric machines and magnets? *A.*—First ascertain, by means of a compass, which is the north pole of the piece of steel or tool which you wish to demagnetize. With a bar magnet using the north pole (which is usually marked *N*), commence at the *S* end and stroke toward the *N* end. Apply a few strokes of the magnet to the piece, and test it again by the compass. If the deflection of the needle is less, the movement has been in the right direction, but if the deflection of the needle is more, the piece must be stroked in the opposite direction. Repeat this operation until the magnetism is removed. If you will remember the following natural laws you will have little difficulty.

A piece of steel or iron may be magnetized by stroking from one end to the other with a magnet, always in the same direction. By stroking in the opposite direction the piece will be demagnetized.

A stronger magnet is required to magnetize than to demagnetize.

A bar magnet made from a round or rat tail file is by far the best as there seems to be something either in the steel or temper which makes it peculiarly susceptible to magnetism.

(3) H. E. G., Allegheny City, Pa., writes: I am a machinist by trade and would like to obtain your views on an argument that I have had with some locomotive engineers on the pulling power of locomotives. I hold that locomotives of equal weight will have the same power to start a train regardless of the size of the driving wheels, provided each has equal cylinder power, and this power be sufficient in both cases to slip the drivers under all circumstances. In other words that one of the ordinary four wheeled pony engines could start just as heavy a train with drivers 66″ in diameter as it could with those of 48″ diameter, (or even a heavier load on account of the larger wheels having more contact surface with the rails) providing the cylinders had the capacity to slip the wheels under all circumstances. The engineers maintain that the engine having the little wheels could start a train that it would be impossible for the other engine to move with the large wheels? *A.*—If we understand you correctly your argument resolves itself into the following question: Will a locomotive having driving wheels of 66″ diameter pull as heavy a train as one having wheels 48″ diameter. The power in both cases being sufficient to slip the wheels and the weight of the engines being equal? It will require more cylinder capacity,—that is more power to slip the large wheels upon the rail than the small ones, consequently a more powerful engine is the result. The larger wheels have more bearing surface upon the rail than the small ones, but, there being no addition of weight, the adhesion to the rail is not increased and the smallest amount of greasy matter that may possibly get between the surfaces will separate them altogether; whereas the smaller wheels have a better grip upon the rails, and should anything of a greasy nature get between the surfaces they are not separated. This principle is well known in connection with the advantages of shaft journals of large diameter over those of a small diameter. The smaller wheels would also have a decided advantage over the large in making more revolutions per minute, thus giving the engines a better opportunity to develope their power.

(4) L. S., Wilmington, Del., asks: Will you, or any of your readers, please to inform me of the best and cheapest process of petrifying wood? In Moore's receipt book, page 564, I find one. Gum salt is one of the ingredients, but I cannot get any gum salt from any druggist. Is the name correct? If so, what kind of gum? Please name some creeks or wells in the country where wood may be put in and petrified. *A.*—The proper reading of the formula noted by you is as follows—"Gem salt, (not gum salt), roche-alum, white vinegar, chalk, and pebbles' powder, of each one equal quantity. Mix all well together. If, after the ebullition is over, you throw into this liquid any wood or porous substance, it will petrify it." The above formula has been before the public in various receipt books and mechanical works for many years past. We have heard of such localities as you refer to, but are skeptical in regard to some of them. Some of the finest specimens that we have ever seen were at Niagara Falls, and were said to have been collected in that vicinity.

Business Specials.

40 cts. a line for each insertion under this head.

Vertical and Horizontal Pumps. Capacity from 100 to 35,000 galls. per minute. Simple, Efficient, Economical, Durable. Used by more than half the tanners and paper makers of the country. Horizontal and Vertical ENGINES, from 10 to 30 H. P., for long continued hard work. Prices, 40 per cent. below other makers. Send for circulars. Heald, Sisco & Co., Baldwinsville, N. Y.

American Watch Tool Co., Waltham, Mass. Lathes, Watch Case, and Clock-Making Machinery.

See Christiana Machine Co.'s adver., next number.

The $4 Drill Chuck, 0 to 9-16. Sent free on receipt of price. Address A. F. Cushman, Hartford, Conn.

Drop Hammers. Stiles & Parker Press Co., Middletown, Conn.

John Fish, M. E. Air Compressors and Working Drawings a specialty. Room 23, 10 Pine St., New York.

For Sale—A New York Steam Engine Co., 21 in. heavy slotter, in good order. Address Southwark Foundry and Machine Co., Philadelphia.

Wanted.—A Radial Drill, 5 or 6 ft. arm. Address P. O. Box 5046, Boston, Mass., stating price and time can deliver.

The right man, with from $1,000 to $1,500, can purchase one-half interest in a boiler shop (good location). Address R. C. D., Box 761, Waterbury, Ct.

Paper Making Machinery—Makers of above from fibrous material as wood, esparto grass, etc., send address to Joshua Rose, P. O. Box 3306, N. Y. City.

Lathes, Planers, Shapers, Drills, Bolt and Gear-Cutters, Milling Machines. Special Machinery. E. Gould & Eberhardt, Newark, N. J.

Engines, Hoisting and Pumping Machinery for Mines. The Band Friction Hoist, which is the safest, simplest, strongest and best in the market. Also, Friction Clutches. Address, Webster Camp & Lane Machine Co., Akron, O.

Dixon's Traction Belt Grease. Dixon's Founders' Perfect Wash. Dixon's Plumbago Foundry Facing. Dixon's Graphite Machine Grease. Dixon's Everlasting Graphite Axle Grease. Dixon's Dry American Graphite Perfect Lubricator. Send for explanatory circular to Dixon Crucible Co., Jersey City, N. J.

Wilkinson & Crowell, 1201 Beach St., Philadelphia, make an Improved Metallic Piston Rod Packing, which is entirely automatic and of great durability. Works well at high or low pressure, and can be used in common stuffing box, or without any stuffing box at all.

Manual of Power for Machines, Shafts, and Belts, with the History of Cotton Manufacture in the United States, by Samuel Webber, C. E., copyrighted 1879. Only work of the kind extant; 240 pages. Price $3. Address, D. Appleton & Co, New York, or the author, Manchester, N. H.

Engines Indicated—Power Measured. W. H. Odell, Box 274, Yonkers, N. Y.

Sheet Metal Presses. Ferracute Co., Bridgeton, N.J.

John Douglass, common and fine patterns made to order, also car wheels, working models, and experimental machinery. Shop at Washburn, Hunts and Co's Wheel Foundry, cor. Warren and Bay Sts., Jersey City, N. J.

MANUFACTURES.

A company has been formed in Philadelphia to manufacture a patented portable hoisting machine, the peculiarity of which is that it uses rope instead of chain, and the rope has no drum on which to wind. It has also an automatic brake to prevent the accidental lowering of a load, but the operator can lower a load quickly or slowly. The hoist will soon be put upon market. The business members of the company are H. C. Wright, manager, H. C. Selby, secretary and treasurer, and T. W. R. McCabe, engineer.

The Atlas Engine Works of Indianopolis, Indiana, are having a large demand for the Atlas Corliss engines from all parts of the county. They are working something over five hundred men, running night and day, and are full of orders.

The Maysville, O., Woolen Mill Co., has been incorporated, with capital $50,000, in shares of $50 each. The incorporators are W. C. M. Baker and others.

The Willimantic Linen Co. have ordered a Lawrence high speed engine for their spool works in Maine. It is 12½ x 20, will make 150 revolutions per minute, and is rated 70 H. P. These engines cost one-third less than the old style engine.

The Springfield, Mass., Steam Heating Co. have decided to increase their works, and will add two steel boilers, having 58 tubes 3½ inches in diameter, and will be made from Benzon steel. They will burn the cheapest grades of coal, having ordered 400 tons of screenings and 100 tons of Nova Scotia culm, and will apply the Jarvis furnace for the purpose. They will also use fine coke and wet peat. The directors investigated the matter of using cheap fuel, and visited several places to see the Jarvis furnace in operation. They unanimously decided to apply the system, which is also to be applied to two large steam heating works in the West.

The Boston Cordage Co. (of Boston) has been incorporated, with a capital stock of $120,000, in shares of $100 each. Geo. C. Pearson, Pres., Charles Davis, Treas.

The International Fuel Saving Co., of Chicago, capital, $1,000,000, has been licensed to incorporate. The object is to purchase and deal in fuel-saving apparatus and machinery of all kinds. The incorporators are Benjamin J. Smith, Collins Eaton, and Samuel Harris.

A building permit has been issued to the Chicago Car Wheel Co. to erect a foundry, 116 × 63 feet, Dearborn St., near Fifteenth St., to cost $10,000.

The rebuilding of Eberhard's saddlery manufacturing works, Akron, O., is to commence at once. Nearly all the chartered capital of the company, $100,000, has been taken.

The Secretary of State has just issued license to organize the American Wind Mill Co., Chicago, capital, $25,000; corporators, Casewell A. Sharpe, A. M. Gilbert, T. S. E. Dixon; also to the Geneva Manufacturing Co., of Geneva, capital, $10,000.

The Lockwood Manufacturing Co., (of Boston) has been incorporated for the purpose of manufacturing "Lockwood's Automatic Leather Scouring and Setting Machines," and other machinery; with a capital stock of $100,000, in shares of $100 each. Howard Gannett, Pres., Frederick A. Lockwood, Treas.

Thomas Wood, Philadelphia, manufacturer of power looms, is making an addition to his factory in order to meet the increased demand for his goods.

Veerkamp & Leopold, manufacturers of Scandinavian locks, in Philadelphia, have opened a branch agency in London, and have already received orders through it from English railways.

Riverside Rolling Mill Co., Riverside, O., has been incorporated, with capital $150,000.

The United States Cord Co. (of Lowell, Mass.) has been incorporated for the purpose of manufacturing cords and lines, with a capital stock of $40,000, in shares of $100 each. Paul Butler, Pres., Prentiss Webster, Treasurer.

A new concern has been organized in Canton, O., called the Boston Equipment Co., composed of Boston capitalists. Its object is the manufacture of rolling stock for narrow gauge railways. It is expected that a factory will soon be established.

The Bridgeport, Conn., cartridge factory has received an order from Turkey for eight million cartridges.—*Boston Comm. Bulletin.*

B. Rosamond, woolen manufacturer, of Almonte, Ont., is building a large worsted factory as an addition to his establishment. The machinery is expected to arrive before the 1st of October.

The new woolen factory at Brantford, Ont., is ready for roofing, and will soon be completed.

The machinery for the new cutlery company at Union City, Conn., has arrived and the works are about to begin operations.

The Dixon Crucible Company, says the *Jersey City Evening Journal*, have removed the frame building next their old axle grease factory, preparatory to the erection of a new six-story brick building, 75x100 ft., the whole of which will be devoted to the preparation of their graphite everlasting axle grease. This is a big country, but we didn't think it had axles enough to require such a building in which to make grease for them. Anyway, the old building has long been too small, as are all the buildings of the J. Dixon Co. We understand the company has long desired to add another story to the lead pencil factory, but have been so cramped with orders for months that they find it impossible to shut down for the time required. Hon. Orestes Cleveland and his able coadjutors have made the Dixon Crucible Company a grand success, and have extended the successful applications of graphite far beyond what the founder of the graphite works imagined possible.

The Chattanooga Foundry and Machine Works, which were established in 1851 at a cost of $150,000, after passing through many vicissitudes, were recently sold, as we learn, for $25,000. Messrs. Lew Owen, C. E. James and J. B. Neely were the purchasers; everything appertaining to the works going with them. These works contain numerous powerful engines, heavy machinery and blast furnaces, all of which have been cared for and are in good condition. There is a probability that the concern will be put in thorough repair immediately and be made ready for operation.

The Gandy Belting Co., a new organization in Pittsburgh, Pa., are about to manufacture cotton belting made of cotton duck, hand woven, folded and sewed after being saturated with a composition to prevent the atmosphere from affecting it.

The affairs of J. Lloyd Haigh, of New York, who failed some time ago for a large amount, have been settled, and his creditors have organized a joint-stock company under the style of the new York Wire and Wire Rope Company, with a paid up capital of $300,000. Mr. R. J. Anderson, of Pittsburgh, is President, and Mr. A. B. Parker, Vice-President.—*Philadelphia Ledger.*

Work is about ready to commence at the new iron foundry in Vineland, N. J. The *Asbury Park Journal* says, "some of the workmen will be imported." The reason for this strange movement is not stated.

The Henry Stewart Manufacturing Company, 326 West 37th street, New York City, are putting in a lot of new machinery made by Brown & Sharpe Manufacturing Company and the Pratt & Whitney Company.

The New York Asbestos Paint Company, which, as the name implies, is to engage in the manufacture of asbestos paint, has been organized in New York City, with James W. Husted as president, and Edward M. Johnson as secretary and treasurer.

Machinists' and Engineers' Supplies.

NEW YORK, July 29, 1880.

The activity in the supply market, as reported last week, continues to increase and inquiries are more numerous. No important changes in values have occurred during the past week.

Messrs. H. S. Manning & Co., 111 Liberty St., New York, have issued a reduced price list on Screw Plates and Dies as follows: No. 1 screw plate and dies, ⅛, 48 threads; 5-32, 40; 3-16, 32; 7-32, 24; ¼, 20. Five pairs of dies with five taps, $4.50. Single pairs of dies, 40 cents. Set complete—plate, dies and taps with adjustable wrench, $6.00. The same with six pairs of dies and six taps in morocco case $6.75. No. 1 plate without dies or taps $1.60. Adjustable tap wrench $1.60. Discount unchanged.

Peter A. Frasse, 95 Fulton St., New York, has just received the first invoice of Hall's New Cutting Nippers No. 4. They are the same pattern as the original size but are 7" long and will cut steel wire of 3-16 inch diameter.

A new jewelers' anvil is being introduced. The design is the same as an ordinary blacksmiths' anvil mounted upon a hollow iron base of novel design. The tool is made of malleable iron, steel faced and nickel plated. The weight is ¾ of a pound.

James D. Foot, 78 Chambers St., New York, has reduced the price of machinists' surface gauges from $2.00 to $1.50 each.

H. Prentiss & Co., 14 Dey St., New York, are introducing a new oil can for the use of engineers and machinists, the peculiarity of which is that it prevents the loss of oil when overturned through accident or carelessness. It also collects the drippings and conveys them back to the can. These cans are made of brass or other metal as may be desired.

The Brown & Sharp Mfg. Co., Providence, R. I., have just issued a new revised and enlarged catalogue. It contains 108 pages (pocket form) and illustrates the different styles of tools and implements manufactured by this company. There are some very important additions of new tools, among which may be mentioned, an Automatic Gear Cutting Engine. The blank to be cut is placed in position, and the machine started, after which the machine takes care of itself, being automatic in its operation as its name implies. We also notice a new Special Automatic Bevel and Spur Gear Cutter, which is composed of two heads placed upon one stand. One of these heads is designed for cutting bevel, and the other spur gears.

We are informed that this company are executing a very difficult and accurate piece of work, it being that of drilling four metal plates, which measure about 2 feet in length, 15 in. wide, and ¼ in. thick. These plates are to be perforated by six hundred holes of ¼ in. diameter. These holes must be so accurately bored that the plates will interchange perfectly. The variation over the whole range of holes must not exceed three one-thousandths of an inch, as that variation would spoil the work.

In regard to changes in prices we copy the following Preface of the catalogue referred to:

"Although prices have generally advanced within the last few months, we have decided, in view of our increased facilities for producing work, to make but few changes in those fixed in Catalogue of January 1, 1879."

A proof-reading inaccuracy in our description last week, of Hewet's patent automatic lock-up gauge safety valve, misspelled the name of the enterprising firm, who are offering this valve to the mechanical public. Instead of Champion & Spencer, the address should be Champlin & Spencer, 154 Lake St., Chicago, Ill.

Iron Review.

NEW YORK, July 29, 1880.

The iron market is quite interesting, but there are few transactions this week. Buyers are waiting to see how firm the recent advance is likely to prove. Furnace owners are firm and confident of better prices in the near future. We quote No. 1, $25 to $26, No. 2, $23 to $24, Forge, $22, Eglinton, $23, Coltness, $25, Glengarnock, $23 and Gartscherrie, $23.50.

Manufactured iron is in fair demand without any very recent advance.

Pierson & Co., 24 Broadway, N. Y., under date of July 29, 1880, quote prices out of store as follows:

Iron Rails, $50 to $57, according to weight; Fish Plates, 2¾c. per lb.; Railway Spikes, 3c.; Bolts and Nuts, 3½c.; Common Bar Iron, 2.4c., basis from store; Refined do. 2.6c., basis; Ulster, 3 6-10c. basis; Machinery Steel, 6½c.; Best Tool Steel, 13½c.; Norway Bar Iron, 6¼c.; Norway Shapes, 6¾c; Nail Rods, 6¾c.; Sheet Iron, 3½c., basis; Angle Iron, 3¼c.; Tee Iron, 3¾c.; Band Iron, 3.4c.; Hoop Iron, 3.6c., and up according to size; Horse Shoe Iron, 3.3c.; Hot Polished Shafting in lengths, 2 ft. and longer, 9 to 10½c., according to size; Small Black Rivets, 30% off in papers; 10% off in bulk.

Carmichael & Emmens, 130 Cedar St., New York, quote prices of Boiler Makers' Supplies as follows:

Flange, 5¼c.; C. H. No. 1 Shell, 4c.; Tank, 3½c.; C. No. 1, 3¾c.; Sheet, 3½c; Angles, 3½c. Boiler Tubes 45% discount from list.

Metal Review.

LUCIUS HART & CO., 8 & 10 Burling Slip, New York, furnish us the following, under date of July 29, 1880:

We have to report a fair business in metals. Markets strong. Pig Tin very firm; London £93, 10s.; Singapore $28. This market nominally, Banca, 23c; Malacca and Straits, 21½c. to 22c.; Billiton and Australian, 21¼c. to 21½c.; English Refined, 21c.; Lamb and Flag, 20¾c.; Pig Lead 4¾c. to 5c.; Antimony, 17½c. for Best Brands; Ordinary, 16½c.; Spelter, "Bertha," strictly pure, 9c.; Western brands, 5½c.; Silesian, 6c. to 6¼c.; Solder, No. 1, 11c¼., "Half and Half," 13¼c.

WANTED.

Wanted—Machinists—Six strictly first-class Vise hands and Fitters accustomed to building machine tools; liberal wages paid by Niles Tool Works, Hamilton, Ohio.

An experienced machinery iron works Superintendent wishes to engage with reliable parties. Address, P. H. L. care AMERICAN MACHINIST office.

Wanted.—A situation as Supt. or Foreman of a foundry or machine shop by a man of experience; a draughtsman and a thorough mechanic. No objection to south or west. Address Mechanic, P. O. box 1338, Boston, Mass.

Wanted by a Mech. Engineer and Draughtsman, 16 years experience, situation as Superintendent or Draughtsman. Address C. R., Box 444, Worcester, Mass.

RALPH R. OSGOOD'S BOOM DREDGE.

Adapted to all kinds of under-water excavation. Guaranteed to excavate 50 per cent. more material from hard bottom than any other machine made, all things being equal. Illustrative pamphlets, comparative strain sheets and estimates furnished on application. ☞ See AMERICAN MACHINIST of July 31, 1880. Address

RALPH R. OSGOOD, Troy, N. Y.

☞ When in New York City will be 81 Astor House.

CARMICHAEL & EMMENS,

130, 132 & 134 Cedar Street, New York,

DEALERS IN

Iron and Steel Boiler Plate,

LAP WELDED BOILER TUBES, &c., &c.

Agent for Otis Celebrated Cast Steel Boiler Plates; the Coatesville Iron Co.; Pottstown Iron Co.; the Laurel Rolling Mills and Union Tube Works.

Wrought Iron Beams, Angles, Tees, Rivets, &c.

BUSINESS FOR SALE.

To close an estate. Established 1838. Has always done a profitable business.

Dealers in Steam Fittings, Engineers' Supplies, Copper, Tin and Sheet Iron Work.

Will not require a very large capital.

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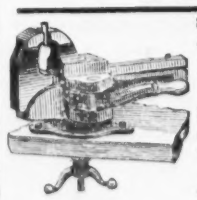

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FOR SALE.

A part interest in western shop. Spring and summer profits have averaged $1,000.00 per month. Purchaser must be able to manage shop, as it is the managing partner who is compelled to sell. Address

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HAMILTON, OHIO.

Model Engines.

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Model Steam Engines, 1 1-2 in. bore, 3 in. stroke, price, $4; ditto, 2 in. bore, 4 in. stroke, price, $10 same style as cut. Gear wheels and parts of Models. All kinds of small Tools and Materials. Catalogue free. GOODNOW & WIGHTMAN, 176 Washington Street, Boston, Mass.

RICHARD DUDGEON,

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Maker and Patentee of

IMPROVED HYDRAULIC JACKS,

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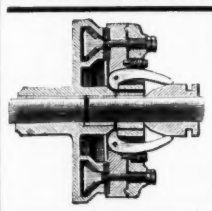

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We manufacture the "Giant Friction Clutch Pulley," known as the "Captain." Is the **Best in the World** for connecting the gearing of callender rolls, hoisting coal, logs or freight. Our Clutch can connect any amount of power, at any speed, without slacking the motive power in the least, and gives no shock, is easy to ship and unship, in *fact*, this is the only Clutch that can do heavy work satisfactorily. **D. FRISBIE & CO., New Haven, Conn.**

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Drills and Machinist's Small Tools.

Attention given to making Drills for special purposes, either straight, flute or twisted. Also, manufacturers of the New Patent Lathe-Drills, to which we would call the attention of those who work in Copper, Brass and the softer metals. For price list and further information address as above, or

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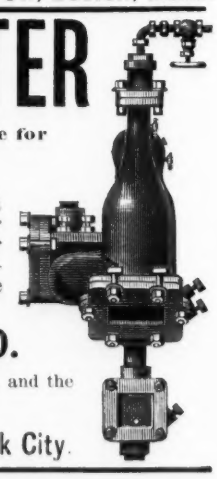

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Messrs. KEARNEY & FOOT, Elizabethport, N. J., July 9th, 1877.

Dear Sirs:—We have for the past ten years used the Files of your manufacture, and during that time we have never had any fault to find with them. We can safely affirm that for evenness of temper, sharpness of cut, accuracy of shape and all other qualities which go to make up a perfect File. They are equal, and in some respects superior, to the best English-made Files. Very Truly, WM. H. INSLEE, Contractor.

Messrs. KEARNEY & FOOT, Elizabethport, N. J., May 3rd, 1877.

Gentlemen:—We have been using your Files, both new and re-cut, for several years, and take pleasure in saying that we have found them a very superior article.

HANS REISE, Contractor, with The Singer M'f'g Co.

We print instructions on the use of Files, and also give the diameters of round and square Files from 3 to 16 inches. They are on card board, 10x12 in., and are intended to be put up in the shop for the men to read. We are pleased to mail them to any manufacturer on receipt of the necessary 6 cents postage.

Respectfully, **KEARNEY & FOOT.**

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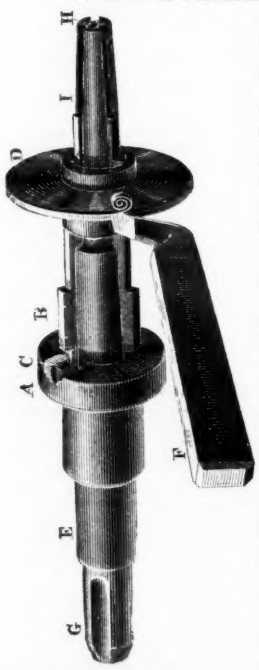

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This Tool is Steel, well made, is Simple, Substantial, Cheap and Useful.

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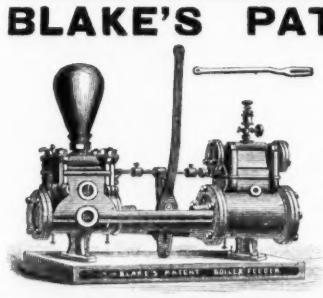

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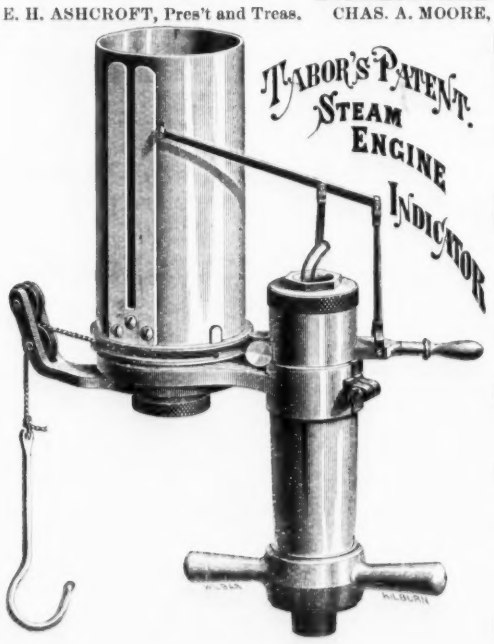

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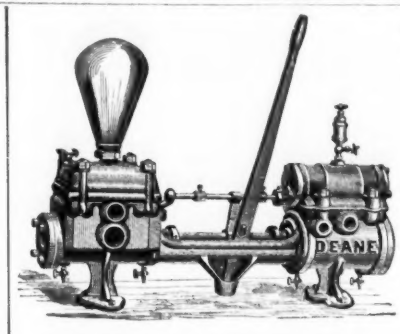

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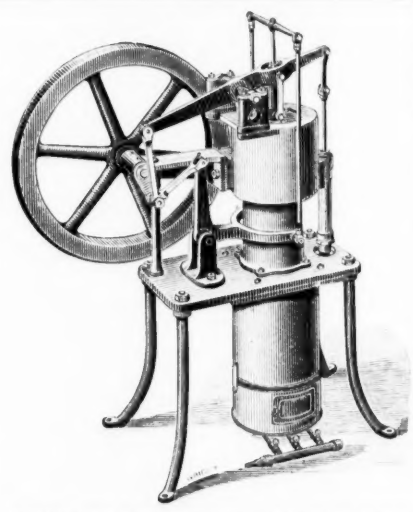

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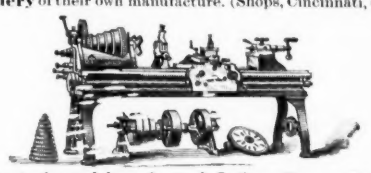

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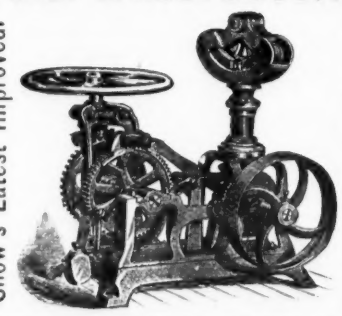

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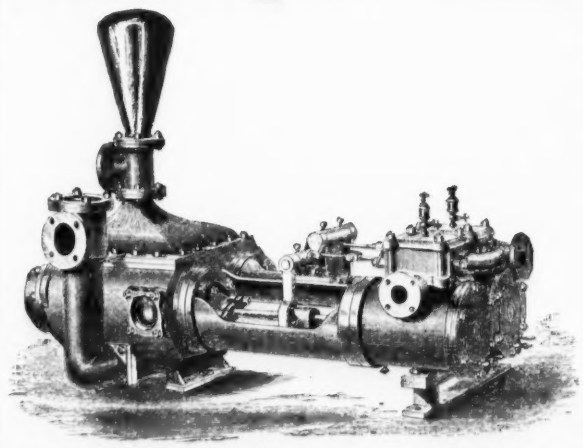

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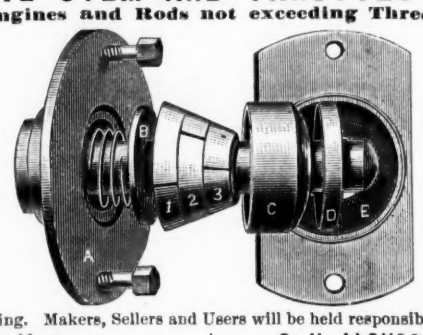

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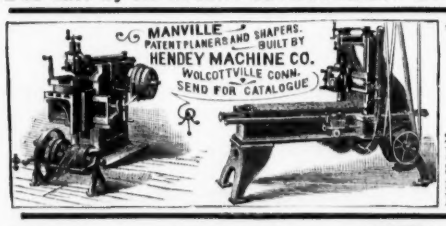

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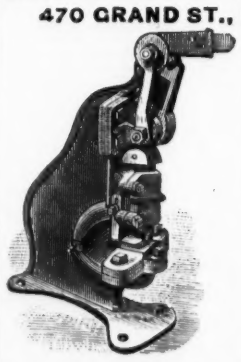

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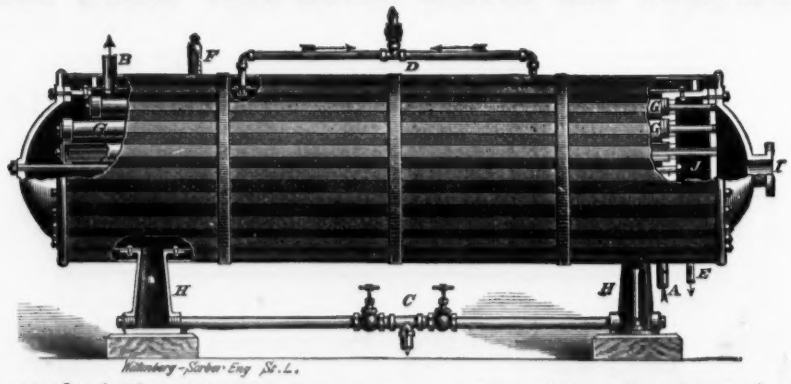

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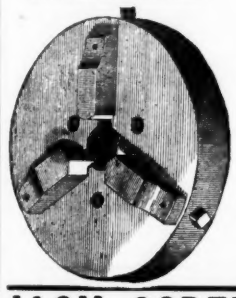

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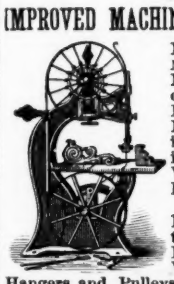

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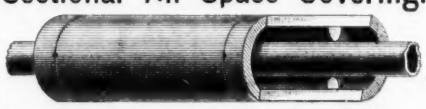

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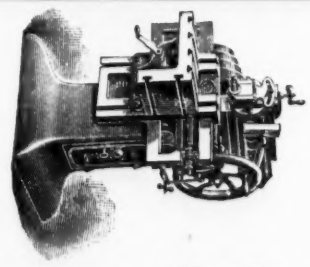

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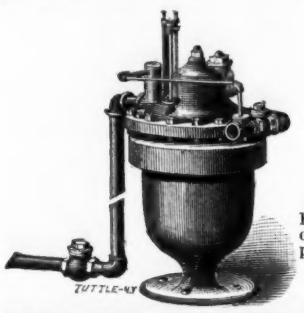

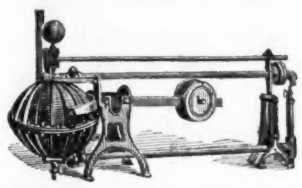

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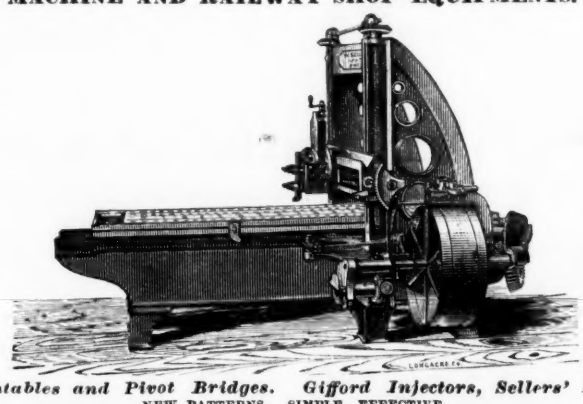

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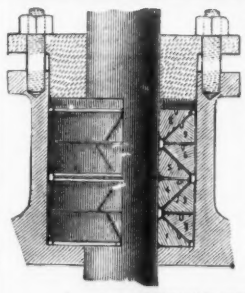

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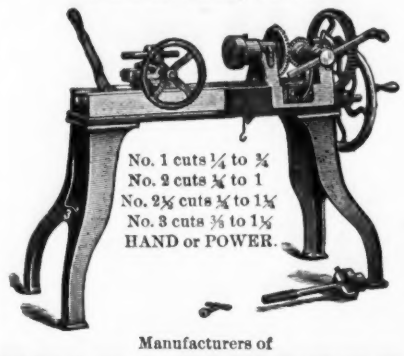

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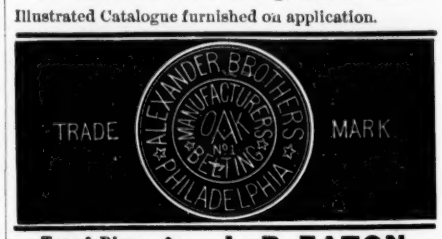

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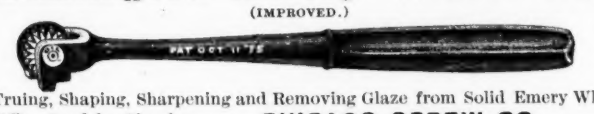

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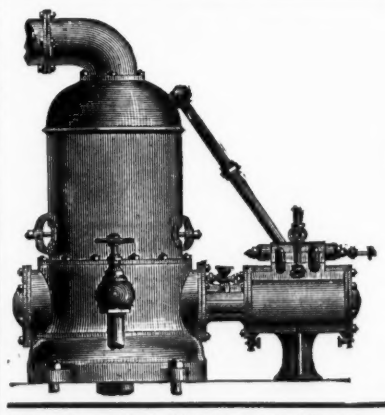

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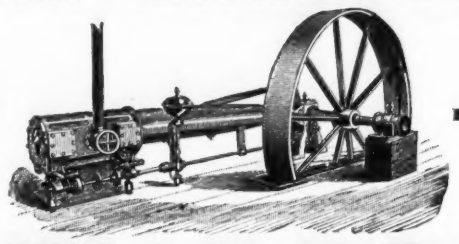

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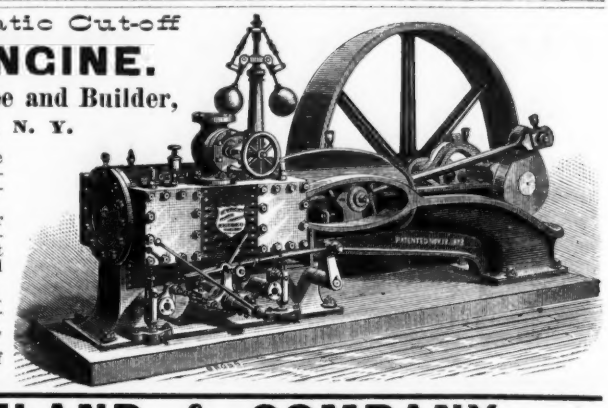

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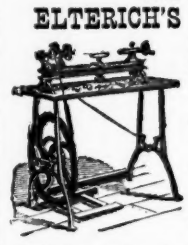

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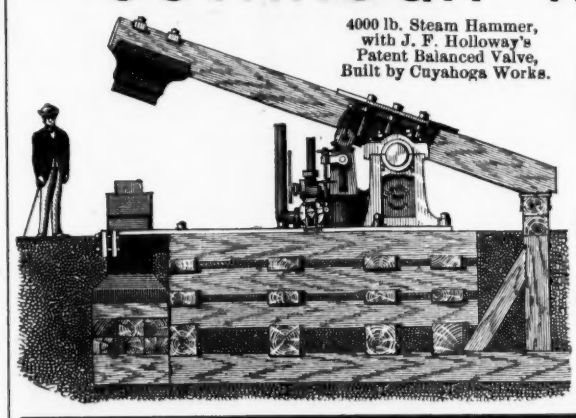

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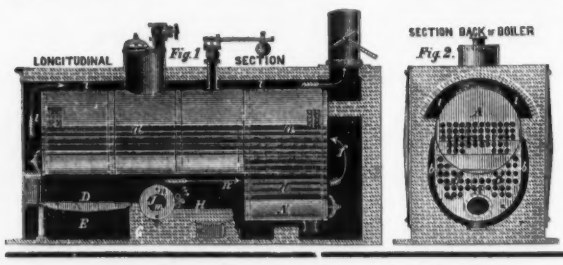

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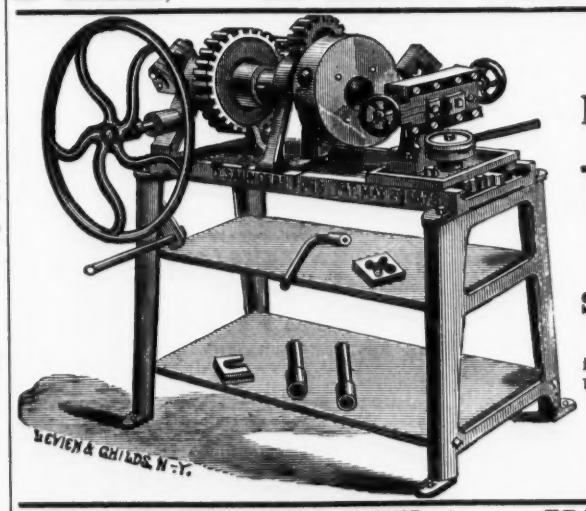

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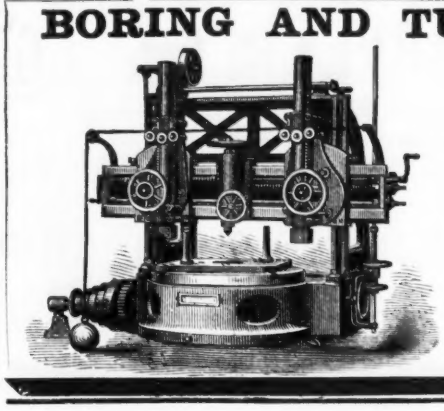

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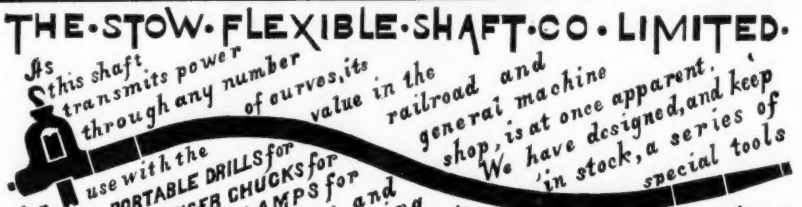
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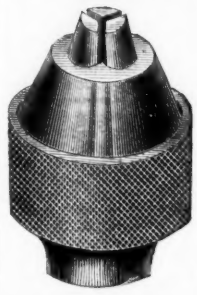

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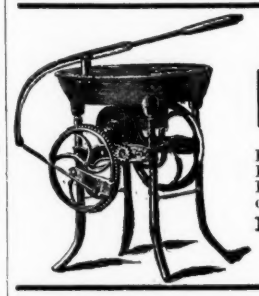

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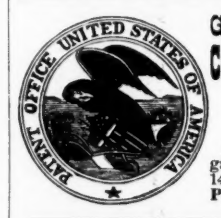

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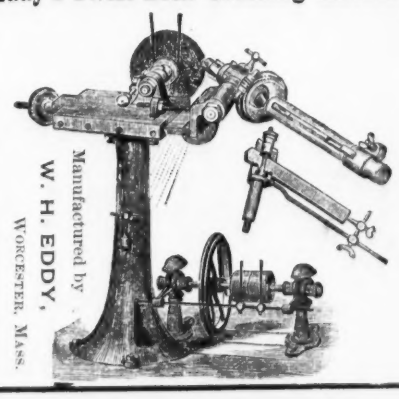

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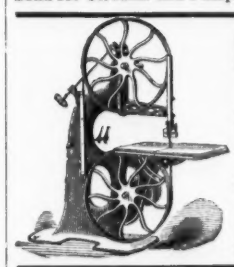

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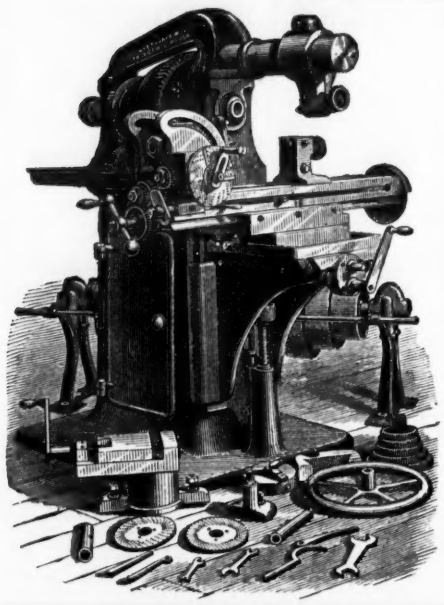

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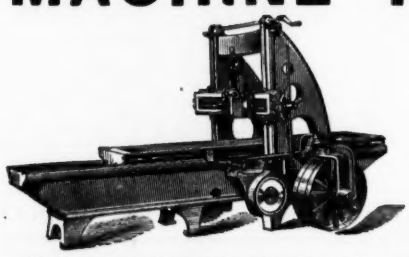

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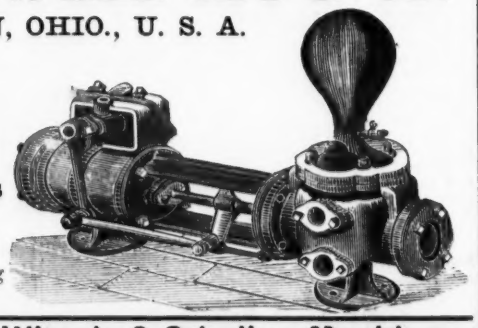

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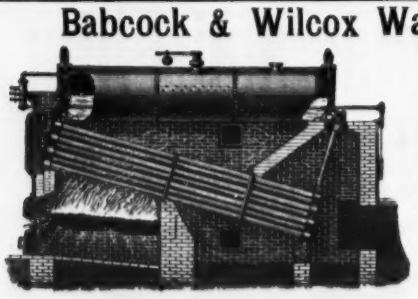

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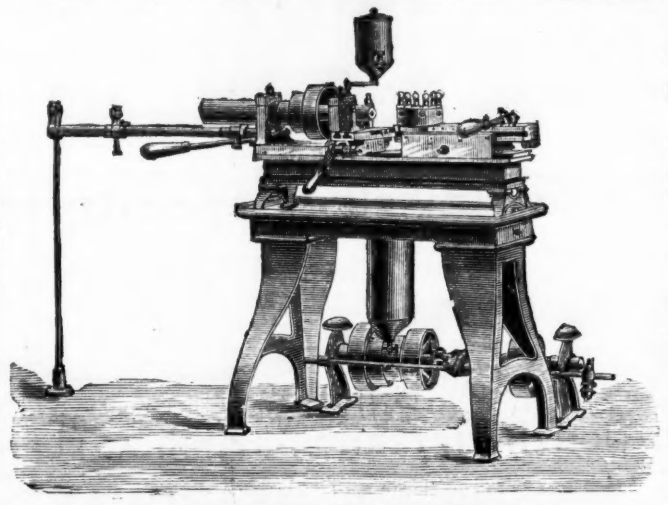

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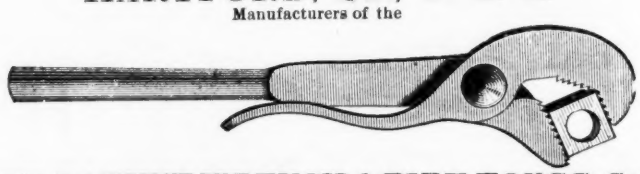

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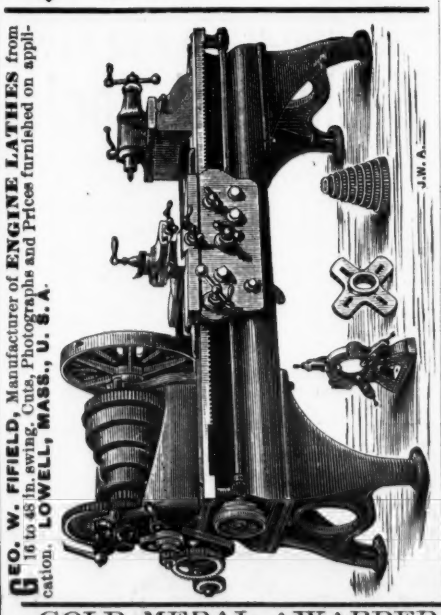

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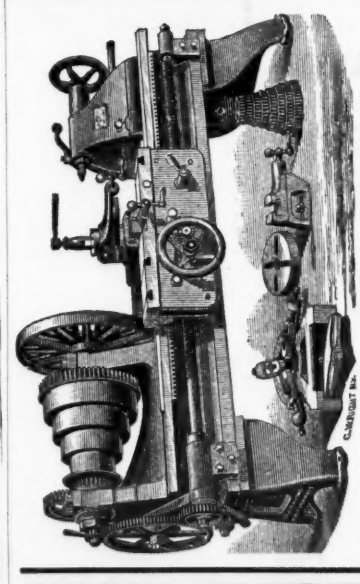

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